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Vol. VI. NEW YORK, OCTOBER 17, 1885. No. 16.

THE sixpenny system telegram is now being tried in England, at last, and is more successful so far than had been anticipated. The rule of charging for the address inclusively leads to some confusion, as incomplete directions are furnished in order to save words. The first day's business showed an increase of 31 per cent. The experiment is on a large scale and will be closely followed.

ELECTRICITY was employed on Saturday last with great effect in blowing up Flood Rock, in the East River, and in noting the appearance and results of the explosion. Among the mementoes of the occasion, sold by boys to visitors next day, were the zincs from the bichromate battery used, and pieces of wire out of the circuits, but no one has yet produced any of the cells or carbons.

THE question of priority of invention in the telephonic field has its humorous as well as its serious sides. Thus, before the question of the invention of the original telephone has been judicially settled, the inventors of subsequent telephones are getting at loggerheads. This is illustrated in the case of Irish's telephone, recently described n one of our issues. Hardly had a description of it been published when our English contemporaries bristled with he letters of inventors who claimed to have made precisely similar instruments at various times, dating back as far as five years ago. Now comes a Frenchman who makes a similar claim, so that it appears that the invention of Mr. Irish has been considerably anticipated. Probably the last of these inventors has not yet been heard from, and the returns from Patagonia are awaited with great interest.

THE thoughts of many electricans have of late turned to the question of the possibility of replacing the dynamo by some development of the thermopile; and it is pretty generally recognized, as Lord Raleigh has recently pointed out, that the difficulty in the way is the too free passage of heat by ordinary conduction from the hot to the cold junction. He shows by mathematical analysis and actual calculation that in the case of German silver and iron, the work obtained by a perfect engine from the conducted heat is 300 times as great as that obtained from the thermo-electric force. From this the conclusion is evident that with the present form of German silver and iron thermopile, the steam-engine and dynamo will continue to hold their own for some time to come.

MR. PREECE'S continued success at lighting his house with storage batteries charged from a dynamo by a gas engine, proves the indisputable fact that when properly handled the original Planté storage cell is a durable and quite efficient apparatus. There can be no doubt that one of the first requisites to long life in these cells is regularity and equality in charge and discharge. By maintaining this rule, Mr. Preece has kept his cells in good condition another twelve months, making in all two years of service, and he claims that they are now as good as ever. His gardener and coachmen are now so well acquainted with the requirements of the plant that Mr. Preece only gives it an occasional supervision, continuing, however, to carry on his tests as heretofore.

THE valuable qualities of ozone are so universally acknowledged that a report of its supposed ill effects must attract notice. Dr. Daniel Draper, in the *Meteorological Journal*, draws attention to the fact noted by him that the observed maximum amount of ozone in the atmosphere corresponded to the maximum rate of death from pneumonia during the months from January to May for each year from 1878 to 1885. These observations cause Dr. Draper to ask whether ozone can cause pneumonia, and whether the treatment with oxygen inhalations is not an error. It may be that the coincidence noted is an accidental one, but the facts are such as to warrant close investigation. Ozone, however, is so well known as a purifier of the atmosphere that its possible injurious action upon the lungs, when the latter are in a diseased state, cannot militate against its employment as a disinfectant. The connection between oxygen, ozone and electricity, although explained by plausible theories, may well enjoy the further research of our physicists and chemists.

WHAT might have been expected has happened. The government has discontinued its suit against the Bell patent, in the Western District of Tennessee, and elaborate explanations of their conduct are given by Mr. Garland, the Attorney-General, and Mr. Goode, the Assistant Attorney-General. As we said last week, some valid excuse would have to be found for the departure from precedent, or the public would express its disapproval very emphatically. It was impossible for the Attorney-General to disregard the criticism brought to bear upon the action of his department, and the outcome shows that the public sentiment in favor of a clean and conservative administration of affairs is far too strong to be resisted. Even if the Bell patent had been obtained unfairly, people do not wish to see it upset by improper methods, and they are above all anxious that the men entrusted with the management of national affairs should be above the suspicion of using their position for the furtherance of their private interests. President Cleveland interposed in a very timely and effective manner, and, so long as Mr. Goode does not mind being made the scapegoat for his chief, no great harm is done after all.

The four operators who went out from this city some months ago to Siam in the Emperor's service, seem to be displeased with his Oriental majesty, and all that pertains to his realms. We expected that in going to such a country they would soon become home-sick, but if it is true that they were hired under any false or veiled pretenses for $120 per month to take the places of "arrogant" Frenchmen who theretofore received $195 per month, it is time for them to come home, and also for our State Department to apply its microscope to the general surroundings. The Siamese Consul in this city says that the French operators—who received $195 per month—became "arrogant." That word is a sweet morsel, which Mr. Franklin B. Gowen, of Pennsylvania, rolled glibly under his tongue and applied to Irish and Welsh miners when he found that he could get a sufficient number of nondescripts from Hungary to do similar work for less pay. Our fellow-countrymen cannot be much better off by undercutting Frenchmen the $75 per month in wages. It will be a queer study for Denis Kearney to see "American cheap labor" in Siam. The whole subject should be investigated.

WE reprint to-day, from the London *Spectator*, a leading journal representative of the best opinions of Englishmen, an interesting review of the electric lighting industry in England. While minimizing the terrific legislative obstacles against which the electric light has had to contend in England, the article paints the future very hopefully. It is, in fact, very cheery about the present. Here is a paper, free from outside or unworthy influences and motives, saying that "slowly, but surely, it defeats gas in all buildings where a great body of light is required," or where the light should be steady and sure; and the most significant part of the article is the warm appeal it makes for a popularization of the incandescent light, so that it may be enjoyed by even the most humble. There is as much room in America as in England for small electric light plants, and it might pay some of the companies here to watch the erection of new blocks of dwelling-houses of moderate size and offer to put in a plant. We are aware that the companies have been too busy with large installations to look after this class of small work, but we believe that any company devoting itself entirely to the supply of plants of two or three hundred incandescent lights for blocks of ten, fifteen or twenty dwelling-houses, would find itself doing in the aggregate a very large and remunerative business; or, as the *Spectator* puts it, "if little groups of houses could once be easily supplied by ordinary tradesmen, the demand for the thing they sell would become a'most limitless." The need for this development grows daily.

ON Thursday, the 1st inst., two great changes, experimental in their nature, took place—one in the Old World and one in the New. England introduced her scheme of sixpenny telegrams of twelve words, inclusive of the address and signature, and America inaugurated her "rapid" delivery system through the mails. Both schemes—rapid transit with regard to inter-communication—form the great question of the day, and should be followed up to their utmost practical capabilities. So far, we think, the Englishmen have the best of us, for their sixpenn'orth of telegram insures them a better delivery at a distance of two hundred miles, than does our twelve cents worth (for it seems the customary two-cent stamp must be added to the ten-cent special stamp) of original chirography delivered at a distance of two miles. It is too early to pronounce mature judgment on the question, but, so far, we can safely say that the new "rapid" postal delivery is no match, either in quick delivery or in obtaining answers, for the old District companies. In the outlying districts of large cities the "rapid" system has thus far been but 10 or 15 minutes ahead of the regular mails, while by actual tests the District companies have returned an answer to the sender before his duplicate message, sent through the special post, was delivered to his correspondent. An outlay of a little money and a system of pneumatic tubes in large cities—such as the Western Union operate in this city—might give us a better postal service, but when we are limited to the leisure of young men whose emoluments are estopped by the majesty of the law at $30 per month, we might as well cast off all hope. If this scheme is, as has been said, a forerunner of a Government monopoly of the telegraph, then we have but small hopes for the Government telegraph. We might as well, as a nation, hire bakers at $30 per month, to bake and peddle bad bread at two cents a loaf less than those who have served a seven years' apprenticeship and have done honest work.

OUR contemporary, the *Scientific American*, in its issue of Oct. 10, has a bitter attack on electric lighting. It says that "the business of the voltaic arc light companies may be said to furnish additional evidence of the credulity of human nature," and in another passage it remarks that "large quantities of lighting plant are manufactured for those provincial projectors who are possessed of robust bank accounts and adamantine credulity." It wants to know why the companies manufacturing plant do not also furnish light, and asserts that "the only people who have profited thus far from the light itself are the gas companies." The manufacturing companies will, no doubt, be amused to learn that the *Scientific American* regards their business as a swindle. They will remember, as we do, that less than a year ago that paper was at great pains to illustrate and describe their respective systems, and that its high encomiums were not wanting. Why has our contemporary changed its tune? We notice that its columns contain no advertisements of electric lighting companies, but we are informed that it has solicited such advertisements and has been refused. This being the case, the rebuff should be borne with better grace. As to the wild expressions about "credulity," we have only to say that the *Scientific American* knows, if it knows anything, that the business is as legitimate as any now carried on in this country, and that already a very large number of the light-supplying companies earn and pay dividends, while almost every dollar actually invested in plant operative to-day is giving a return in profit. The *Scientific American* thinks that the companies manufacturing plant ought also to sell light. It does not follow at all, any more than it follows that the manufacturers of soda-water apparatus ought to "run" the fountains to be found every where. As a matter of fact, however, the manufacturing companies are often directly interested in local lighting plants, and propose to continue so, as the investment is a good one. Electric lighting is a grand success, and the wanton attack of the *Scientific American* will not convince a single man to the contrary.

An Unnoticed Danger in Certain Apparatus for the Distribution of Electricity.

Among the plans which have been tried for locally transforming a supply of high potential to a lower and safer, the most promising is by the use of secondary generators or induction coils. It has been proved that this method can be used with great economy of electric power, and with convenience; under proper construction of the induction coils it may also be perfectly safe. Dr. John Hopkinson, however, has recently pointed out that it is easy and very natural so to construct them that they shall be good in all other respects but that of safety to life—that they shall introduce an unexpected risk to those using the supply.

In a distribution of electricity by secondary generators an alternating current is led in succession through the primary coils of a series of induction coils, one for each group or system of lamps. The lamps connect the two terminals of the secondary coil of the induction coils. It is easy to so construct the induction coils that the difference of potential between the terminals of the secondary coils may be any suitable number of volts, such as 50 or 100, whilst the potential of the primary circuit, as measured between the terminals of the dynamo machine, may be very great, *e. g.*, 2,000 or 3,000 volts. If the electromagnetic action between the primary and secondary coils, on which the useful effect of the arrangement depends, were the only action, the supply would be perfectly safe to the user so long as the apparatus with which he could not interfere was in proper order. But the electro-magnetic action is not the only one. Theoretically speaking, every induction coil is also a condenser, and the primary coil acts electrostatically as well as electromagnetically upon the secondary coil. This electrostatic action may easily become dangerous if the secondary generator is so constructed that its electrostatic capacity, regarded as a condenser, is other than a very small quantity.

Dr. Hopkinson demonstrates mathematically that secondary generators of large capacity are essentially dangerous, even though the insulation of the primary circuit and of the primary coils from the secondary coils is perfect. The moral is, that the constructor should take care that the secondary generators have not a large electrostatic capacity, say not more than .03 microfarad, better less than $\frac{1}{100}$ microfarad; and the inspector should test the system for safety. The test is very easy. Place a secondary generator of greater capacity at one end of the line, and connect its secondary circuit to earth through any instrument suitable for measuring alternate currents under one ampère; put the other end of the primary to earth; the reading of the current-measuring instrument should not exceed such a current as it may be demonstrated a man can endure with safety.

Domestic Electric Lighting.

At the recent British Association meeting, after referring to the full details of the lighting installation of his house in Wimbledon, given to the section at the meeting at Montreal, Mr. Preece referred generally to the experiences he had gained during the past twelve months. The secondary batteries upon which he had mainly relied exceeded his expectations in the services they rendered. They returned 70 per cent. of the energy put into them without any apparent diminution whatever in their E. M. F. They showed no signs of deterioration, and gave no trouble whatever. He used his gas engine for charging only two days a week. He had experienced no fault with the wiring of his house. He had used only the very best materials, and had attended personally to the insulation of the system. It was periodically tested, and found to be good. He referred in severe terms to the cheap and nasty wire which was so frequently and ignorantly used, and feared that the prejudice against the electric light would increase when failures from this cause arose. None but the very best materials should be used, and the joints should be seen to by experts. He had devoted considerable attention to the problem of distributing light, and had succeeded so far that, while his rooms were beautifully illuminated, the eye was not irritated by regarding a bright source of light. The lamp he used was a 50 volt 10 candle-power glow lamp, and it was as a rule so fixed that the eye never saw it. He had arrived at the use of these lamps after careful consideration and many trials of other lamps. They secured greater safety in the leads, and involved less capital in batteries through the use of low E. M. F.

He had introduced into the charging lead, and into the discharging lead, a Ferranti meter, so that he was able to record exactly the quantity of electricity passed through the batteries and that passed through the lamps. This beautiful meter is based on Ampère's laws which determine the attraction and repulsion of currents. A small phosphor-bronze vane is immersed in a bath of mercury through which the current flows and is radially fixed in the magnetic field. The mercury rotates and carries with it the vane. The rate of rotation varies directly with the strength of current, and the number of rotations are recorded by a counter, which can be read off directly. So far, he was perfectly satisfied with its performance. As regards expense, excepting the first cost, he did not find much addition to his expenditure for illumination. His electric light was costing him about £50 a year for gas, wages, oil and lamps. It was the cheapest luxury he indulged in.

It was said that he as an expert could make things go which would fail in ordinary hands, but he mentioned several cases where coachmen, butlers, gardeners and grooms had been found perfectly competent and intelligent enough to attend to everything.

Electric Light Switch.

We illustrate below a form of switch invented by Mr. N. G. Thompson and described in the London *Electrical Review*.

This switch, Figs. 1 and 2, has been constructed with a view to balancing the pressure generally found necessary to form good contact, and to compensate for wear and tear. In the majority of switches now made for heavy currents, the requisite pressure is given by means of a spring acting on a spindle, which throws the wear and strain on that part. This is obviated in Mr. Thompson's

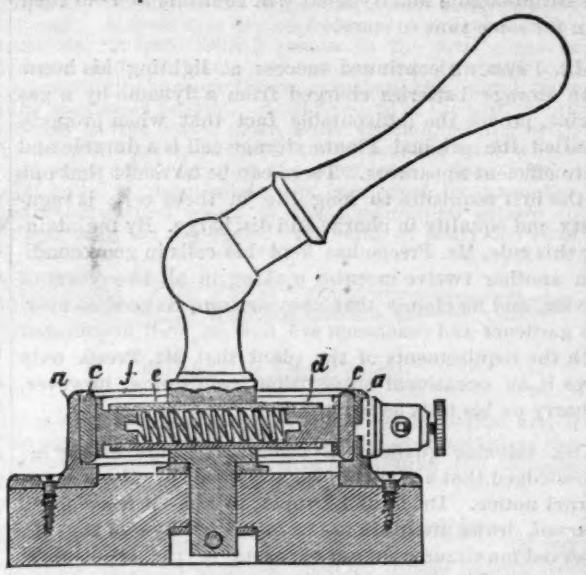


FIG. 1.

switch by making the contact plates in the form of a cylinder cut into segments *a*, *a*, *a*, and secured by a flange to the wood base *b*. Two plugs *c c* are fitted loosely into the cross tube *d*, and are forced out against the segments by means of the spiral spring *e*. A strip of metal in the form of a bow *f* is also secured to the plugs *c*, *c*, and any convenient handle is attached to the tube *d*. It will be seen

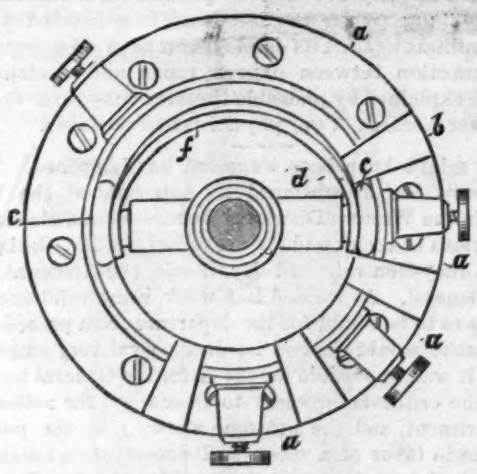


FIG. 2.

from this that the pressure on the segments is completely balanced, without in any way affecting the spindle and handle to which the tube is fixed. The bow-shaped piece of metal *f* conveys the current from one plug to the other and at the same time aids the action of the spiral spring. The result of this balanced action is to make the switch remarkably free to move and at the same time permits of the desired pressure.

New Insurance Regulations for Incandescent Lighting.

In our last issue we gave the new rules and regulations relating to incandescent lamps on arc circuits, adopted by the New England Insurance Exchange. The new rules relating to incandescent lighting, while modeled on the existing ones, have several additions and modifications which are of interest, especially as bearing upon the subject of testing, wiring and insulation.

TESTING.

Companies or individuals furnishing electricity from central stations must enter into an agreement with this Exchange binding themselves to maintain at all times, in their station, some approved device to act as an automatic "tell-tale," indicating instantly any "escape" to earth tending to seriously impair the insulation of the system or affect the working of the lamps; or to develop leakages to water, steam or gas-pipes, or other metallic earth connections within the walls of buildings.

WIRES AND INSULATION.

Copper wire used for incandescent lighting must be procured from manufacturers whose products have been found, by reliable tests, to be at least 95 per cent. pure copper. Samples of wire to be used, or in actual use, must be submitted at any time when required, to this Exchange, for tests of conductivity. Permission will not be granted for the use of the lights unless the wire comes fully up to the standard of conductivity, no matter how well the wiring may be done.

All parties, firms or corporations proposing to do construction work or wiring, either outside or inside, should, in order to secure the ultimate approval of their work, first satisfy this Exchange of their ability to do so in a safe and acceptable manner. They will then be supplied (if they desire it) with cards giving samples of approved insulation and a statement of conditions under which each sample may be used. Before using any new forms of insulation for concealed work, the approval of this Exchange for its use under the proposed circumstances must be secured.

When secured by cleats not over four feet apart, and tightly stretched in the same horizontal plane, wires having a difference of potential of 150 volts or less, should be separated at least one inch; where the pressure exceeds 150 volts they should be two inches apart; where they are confined in moldings in *thoroughly dry places*, one-half this space is sufficient.

In stables, dye-houses, paper and pulp mills, or other buildings specially liable to the condensation of moisture, all wires carrying one ampère and upwards (excepting those within the pipes of the fixtures) should be separated at least six inches; and where vapors of ammonia or other corroding gases are liable to arise, they should be separated by a still wider space. The placing of two wires of opposite polarity (or of the same polarity when on separate switches) close together, will not be approved. In all places of this class, painted cotton insulation is prohibited, and some thoroughly waterproof covering, such as rubber, must be employed. The wires must be supported on glass or porcelain insulators. This wiring must show an insulation resistance between the ground and circuits of one megohm.

When fixtures are used for both gas and electricity, the insulation from the gas system at the top must be supplemented by careful insulation of the electric attachments from the body of the fixture.

No portion of the lamp-socket exposed to contact with outside objects must be allowed to come into electrical connection with either of the conducting wires.

Cut-outs and switches, when connected for carrying currents of five ampères and upward, *must* be double-pole. The "plug," or other device for inclosing the fusible wire or strip, *must* be incombustible and moisture-proof, and constructed in a way that its terminals will be so far apart that an arc could not be supported through the vaporizing of the fusible material by the E. M. F. employed.

In the regulations relating to the arc system the following has been added:

In all cases where there are telegraph, telephone, or other wires for conducting currents of low electromotive force in the vicinity of electric light or power circuits, and liable to come in contact with each other by accident to either, the Electric Light or Power Company should arrange with the parties controlling such other wires to have "safety fuses" or "fusible strips" inserted into their circuits between the line wires and instruments, to avoid danger in case of contact and excessive current being thrown on to such other wires. The "safety fuses" should be inserted each side of any possible contact.

The Electric Light and Atmospheric Absorption.

The lighthouse experiments conducted at the South Foreland, England, besides showing the superiority of the electric light, have brought out another interesting fact regarding its power of penetration in foggy weather. In a paper on this subject Prof. Forbes, one of the committee who undertook the tests, makes the following interesting remarks:

Whenever the electric light was exposed the illumination of the fog was white, but whenever the gas was exposed the illumination was yellow or orange-yellow. The illumination of the fog was of the same color as the source of light, showing that with a mixture of air and vapor in the form of steam, forming a cloud without the admixture of other substances, rays of different colors were absorbed, and scattered very nearly in the same proportions. Here also Mr. Dixon's observations agree with mine, for he says, "Long before the actual lights were seen, the fog was brightly illuminated by the lights, the *blue* tint of the electric light greatly predominating." In this case those blue rays, which some say are so readily cut out, can still be seen. This shows that the proportion of the electric light which is scattered by such a fog is no greater than the proportion of any other source of light.

The experiments have shown that, using the large Mew Island lens with the Wigham gaslight of 2,400 candles, and the smaller lens with the electric light of five times the power, or 12,000 candles, the electric light in clear weather was at least sixteen times as bright, and in foggy weather was about thirteen times as bright as the gaslight, the excess of absorption for the electric light being about 20 per cent. more in foggy than in clear weather. The experiments have also shown that the electric light is at least of twelve times the intensity with the large Mew Island lens as with the smaller lens; hence the illumination which would be given to the mariner from the electric light by using the same lens as for gas is from 150 to 250 times as great as is given by the gas.

On Contact Electricity in Common Air, Vacuum, and Different Gases.*

BY J. T. BOTTOMLEY.

The discussion at the British Association meeting at Montreal last year on the seat of the electromotive force in the voltaic cell, the paper of Prof. O. Lodge, which resulted from that discussion, and the subsequent discussion at the Society of Telegraph Engineers, must have brought forcibly before the minds of those interested in the subject the extremely unsatisfactory state of our experimental knowledge on some of the fundamental questions relating to contact electricity. Foremost among these, perhaps, is the question of the behavior of various metals as to Volta contact effects in air. I have undertaken a series of experiments on this subject, and I have already obtained some definite results, although the experiments which I have made up to this time are only to be considered preliminary to a fuller inquiry.

For determining the value of the Volta contact effect, I have used the quadrant electrometer and the compensation method of Sir William Thomson.

The plates which I have used are zinc and copper discs, a little larger than a shilling. Testing them first with full air pressure, I found that the Volta contact difference was rather over 0.74 volt; which is as nearly as possible what has been found by previous experimenters, and by myself experimenting a few weeks ago with Sir William Thomson's old contact apparatus.

The air was then very carefully exhausted; the exhaustion being maintained for two days, and finally made exceedingly good with 2½ hours' work at the pump, just before testing. The pressure during the testing was not greater, and was probably much less, than $\frac{1}{12}$ mm. of mercury or 2.5 M (2½ millionths of an atmosphere). The electrical test was then applied, and the value of the Volta contact effect was found to be *exactly the same as before*, a little over 0.74 volt. The final test, however, consisted in allowing the air to come back into the apparatus, and then testing electrically. This was done by breaking the point of the sealed tube, and as the air entered, the electrometer test was rapidly applied. So far as the sensitiveness of the testing apparatus goes, there was absolutely no change in the Volta contact difference.

My experiments, therefore, are absolutely contradictory, so far as they have gone, to those of Dr. W. von Zahn, quoted by Professor Lodge, who experimented in a high vacuum, and found the Volta effect to be diminished and to be represented by a potential difference of only half a Daniell.

I have also experimented on hydrogen and oxygen gases in this apparatus in a way precisely similar to that described above. The chamber was very carefully exhausted, and the Volta contact effect tested with the electrometer. Hydrogen was then admitted, and while it was entering, which it was forced to do slowly, the electrical testing was repeated several times.

A second and a third exhaustion was made, and hydrogen admitted a second and a third time. The same was subsequently done with oxygen, except that it was, of course, sufficient to admit the oxygen a single time. The result of my investigation, so far as it has gone, is that the Volta contact effect, so long as the plates are clean, is exactly the same in common air, in a high vacuum, in hydrogen at small and great pressure, and in oxygen. My apparatus and the method of working during these experiments was so sensitive that I should certainly have detected a variation of one per cent. in the value of the Volta contact effect, if such a variation had presented itself. To do away with all question as to the dependence of the Volta effect on "ancient air sheets," I propose to modify my apparatus by making the vacuum chamber much longer, and finally of combustion tubing. I shall then apply great heat to the plates while they are contained in a vacuum as high as I can command. If, then, there be any ancient air sheets existing, they must either be driven off or else absorbed into the plates. If any gas be driven off, it will be removed by the pump. The plates will then be tested when they have perfectly cooled, and the value of the contact difference determined. That being done, the atmospheric air or some other gas will be admitted, and the contact difference will be again determined. The effect of the pressure of the atmosphere or other gas will, I think we may safely suppose, be thus ascertained.

*Abstract of paper read before the British Association at Aberdeen.

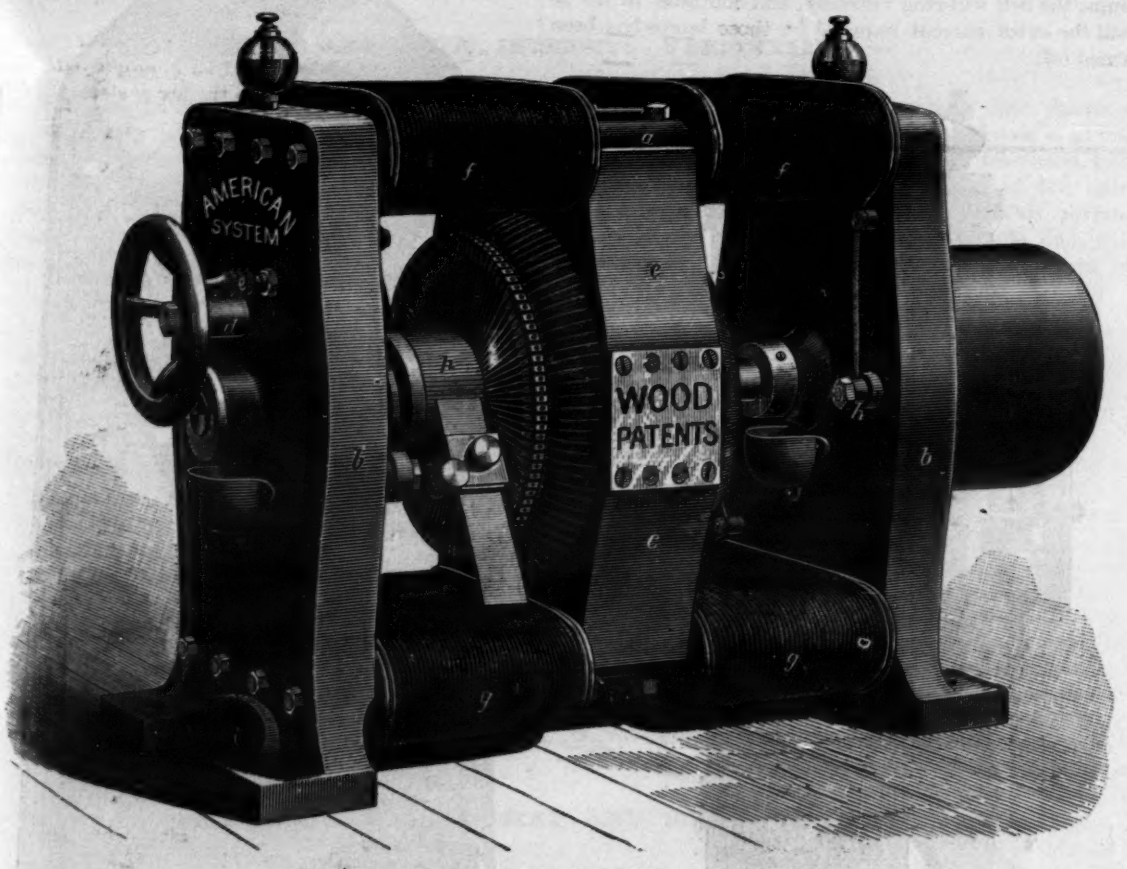


FIG. 1.—THE WOOD-GRAMME DYNAMO.

The Arc System of the American Electric Manufacturing Company.

As announced by us recently, the American company has adopted a system which has been developed by Mr. James J. Wood, and which was one of the first put in practical operation in this country. As it is destined to occupy a prominent position in the near future, we propose to describe it in full, as it presents several interesting features and comprises every detail required by a system in order to be successful. It embraces besides the dynamo a number of lamps adapted to various purposes, the mechanism of which is very ingenious. We give this week a description of the former, with the regulating and indicating apparatus.

The dynamo, shown in Fig. 1, in its electrical connections is the same as the Gramme machine. The field is constructed of rectangular bars *a*, *a*, of wrought iron, with rounded edges, and the ends *b*, *b*, of heavy cast-iron plates. The pole-pieces are of cast iron, bolted to the rectangular magnetic bars, and secured at their ends by non-magnetic composition plates. The hand regulator, *d*, which is on the front end of the machine, is a hand-wheel designed for placing the brushes in a position around the commutator from the maximum to the minimum point, or *vice versa*, as required. The wheel is graduated so as to represent the number of lights the machine is designed to operate. A spring latch, *e*, holds the wheel in a position corresponding to the graduation, to represent the different number of lights.

Fig. 2 represents a perspective view of the armature of the machine. Figs. 3 and 4 represent a sectional elevation and end view, showing its interior construction. In the sectional elevation *i* represents the spider, which is made of gun metal, and to which the iron ring *j*, on which the coils of copper wire are wound, is fastened, the whole being firmly keyed to the shaft *k*. This ring, which is composed of annealed iron wire insulated in process of manufacture, is in direct contact with the gun-metal spider, the object of this being to absorb any heat that may be produced in the ring *j*. The spider is so constructed as to produce a fan-like motion, causing a strong current of air to circulate through it, dispersing the heat as rapidly as produced. The small caps *l*, *l*, held by screws *m* *m*, hold the iron ring of the armature in position. The

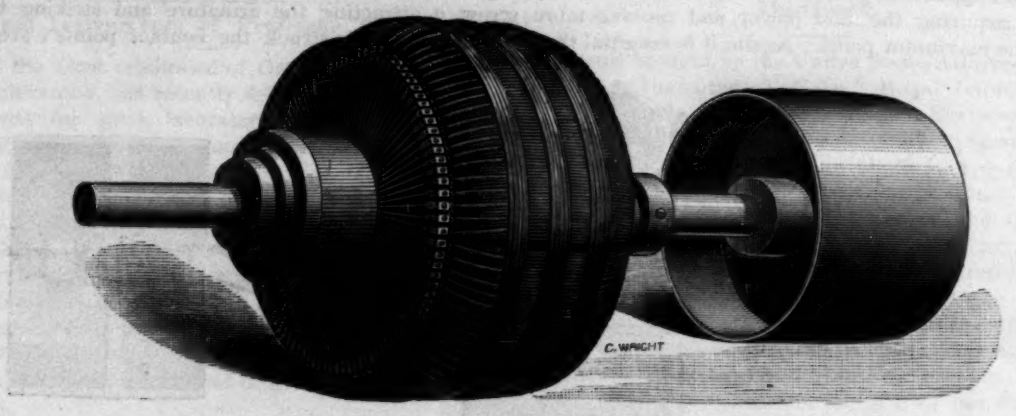


FIG. 2.—ARMATURE OF THE WOOD-GRAMME DYNAMO.

wooden strip *n* with the space *o*, of which there is one in each arm, prevents the generation of currents in the caps *l*, *l*, and also serves as a means of balancing the armature. The commutator *p* is composed of sections of copper insulated from one another, and so constructed that any section can be removed without materially interfering with the remaining sections. This commutator is connected with the armature by a peculiar form of screw clamp *r r*, and is not soldered. Another peculiar feature in the construction of the Wood armature consists in the fact that where the connecting wires are attached to the commutator, they are enlarged to four times their regular sectional area, which enlargement continues as far back as the bands *s*, *s*, *s*, so that the wires are held rigidly in position, thereby preventing any tendency to vibrate or break.

The Wood automatic regulator for adjusting the current according to the number of lights in circuit is shown in Fig. 5 and Fig. 6, which represent respectively a front elevation and side view. In its operation, the electro-magnet *t*, *t*, seen on the side *b* of the generator, which is interposed in the main circuit, attracts an armature *u*; this attraction is opposed by a spring, the movement of which is retarded by a dash-pot. In case one or more lights are turned off, the resistance of the circuit being decreased, the electro-magnet *t*, *t*, is more strongly energized, attracting its armature *u*, which through the agency of the lever *v*, presses the inside rim of the friction-wheel *w*, against the roller *x*, that is on the end of the armature shaft *k*; through the agency of gearing the latter causes the brushes to be moved toward the minimum point, until there has been a sufficient reduction in the strength of the current, and consequently in the attractive force of the electro-magnet *t*, *t*, to allow the spring to again pull the lever to its intermediate position. In case one or more lamps are turned on, the resistance of the circuit will be increased, the strength of the electro-magnet *t*, *t*, will be proportionately diminished, and the spring acting in opposition to it will press the outside rim of the friction wheel *w*, against the roller *x*, causing the brushes to move toward the maximum point, until the current and also the electro-magnet *t*, *t*, again assume their normal strength. When all the lights are turned on and the machine is running at its proper speed, the brushes will assume their maximum position. In case the speed of the machine should be diminished from any cause while the full number of lights are burning, thus reducing the current, the regulator would atomatically tend to move the brushes to a position beyond the maximum point in its endeavor to maintain the standard current required. As the brushes cannot be moved further than the maximum point, the electro-magnet *t*, *t*, would diminish in strength, increasing the friction and tending to wear the wheel *w*, at the point of contact with the roller *x*. To prevent this the wheel *y*, that gears directly with the section of the yoke, holding the brushes, is so proportioned that it only makes ¼ of a revolution, in moving the brushes from the maximum to the minimum point. It has a pin z^1 on its side, which engages with a projection *z* on the lever *v*, raising it so as to automatically release the pressure of the friction wheels *w* and *x*, thus obviating any tendency to wear. Another feature which this regulator has, is that the wheel *y* is graduated around the periphery, so as to represent the number of lights the machine is intended to operate. As the wheel assumes a position depending entirely on the number of lights in circuit, the figures on the rim act as an index to inform the engineer of the number of lights his machine is operating. In case several lights are extinguished at once, the electro-

magnets are energized to a considerable extent beyond their maximum power, increasing the pressure proportionately on the friction wheels, causing them to move very much faster than would be the case if but one or two lamps were extinguished, and reducing the current more rapidly. It will also be seen that the inner rim of the friction wheel *w* is only about one-half the diameter of the outside rim. The advantage of this is two-fold: first, the inner rim, which is the smaller, moves the brushes toward the minimum point in the same direction in which the commutator is revolving, requiring the least power, as the friction of the brushes on the commutator assists it; on the other hand, the outer rim, which has the greatest leverage, moves the brushes in a direction opposite to that in which the commutator is revolving, requiring the most power, and moving more slowly to the maximum point. Again, it is essential that the extra current be interrupted as quickly as possible when the lights are extinguished, and, when lights are put in circuit, that the current be increased more slowly, so as to prevent sparking. The regulator is instantly effective in its operation, so that any number of lights may be turned off at once without endangering the safety of the machine,

Mr. Wood has also invented an apparatus for use in connection with the automatic current regulator, which is placed in the main circuit and connected with the current regulator in such a manner as to automatically shunt more or less of the current from the electro-magnet *t t*. The object of this apparatus is to increase the sensitiveness of the regulator so that the slightest change in intensity of the current will cause a far greater change in the strength of the regulator-magnet *t t* than that which occurs in the field-magnets *f g*, making its operation in either direction more rapid.

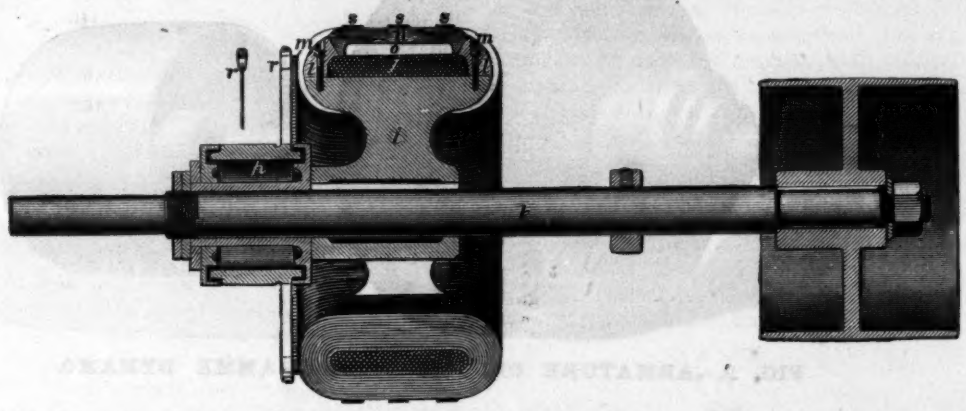
The Wood indicator and alarm, illustrated in Fig. 7, is designed to be used in circuit with dynamo fitted with the hand regulator, where the lights are operated from the central station, so as to enable the users to turn them off at pleasure. Referring to the illustration it will be seen that the current entering at the binding post *a* passes through the magnet coils *b b*, thence to the stud *c*, around the magnet coils *d d*, and back through the frame-work of the instrument to the binding post *e*, off through the lights, and thence to the generator. It will be observed that the current in passing through the magnet coils *b b* and *d d* will strongly magnetize their cores. The cores of the magnet *b b* have polar extremities formed with eccentric faces, so that they tend to attract the armature, carrying with it a pointer in a direction so as to produce a deflection of 45° on the scale. The armature *f* of the bell is held against a stop *g* by a spring *h*, which balances the attractive force of the magnet when the current flowing through the coils *d d* is normal.

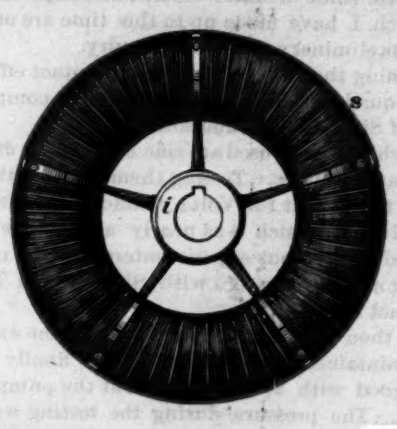
The indicator is connected in the engine-room with the electric light circuit, and the current flowing through the instrument is the standard current necessary for this number of lights. In case of the extinguishment of one or more of the lamps, the resistance of the circuit will be diminished, the quantity of current increased and the pointer of the indicator will move past its normal position, due to an increased attraction of the magnets *b b*. The magnets *d d* will also increase in strength, overbalancing the spring *h* which holds the armature against the stop-screw *g*, attracting the armature and striking the bell. When the bell is struck the contact points *i* are closed, which shunts a portion of the current from the magnet-coils *d d*, causing it to release the armature *f*. This operation will be repeated until the engineer in charge sets the regulator of the machine, so as to reduce the current, provided, of course, that the automatic regulator is not used.

In case the lights are turned on, the resistance of the circuit will be increased; the pointer will then fall below its normal position. The engineer will then set the regulator so as to supply the lamps with more current, until the pointer comes back to its original position. In case of a short circuit occurring on the line, so as to cut out several lamps, the bell will ring violently, and continue to do so until the extra current required for those lamps has been turned off.

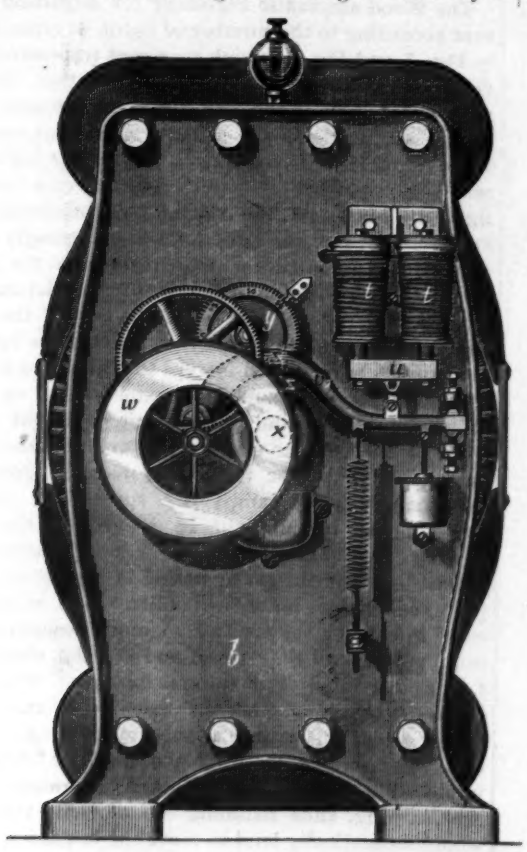
It is evident that no local battery is required, as the bell is operated by the same current which operates the lamps.

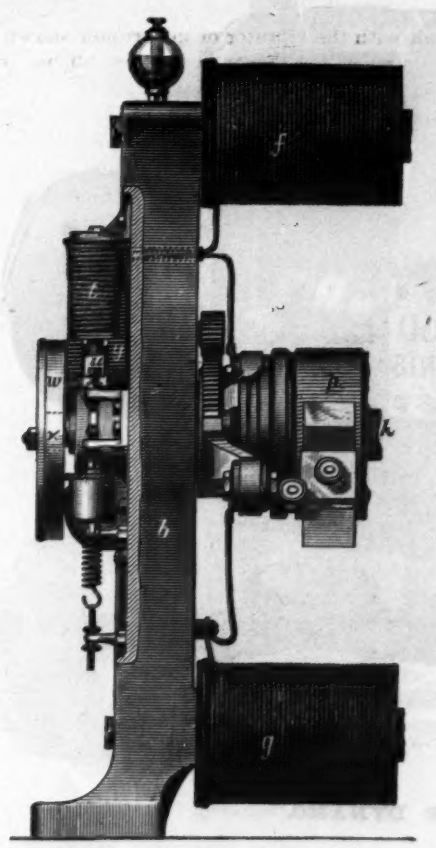
We have thus far treated only of the dynamo and regulating mechanism of the Wood system. We shall later describe the lamps, of which there are several different forms.





FIGS. 3 AND 4.—SECTIONAL VIEW OF WOOD-GRAMME ARMATURE.





FIGS. 5 AND 6.—WOOD AUTOMATIC CURRENT REGULATOR.

FIG. 7.—INDICATOR AND ALARM.

The Era of Bucket Shops.

The great rise in stocks in 1879 forced many of the largest bucket shops to the wall, as their customers were "long" of the market, and the "game" therefore lost heavily. The Stock Exchange folks breathed easier, but in a short time they settled with their customers and started the business again, but limited the amount of profits to five per cent.

About the time the business had attained the highest kind of prosperity, and good clothes were worn by the bucket-shop traders, as well as the proprietors, there burst upon the scene an angular young man, standing about six feet in his stockings, with crooked fingers and a Boston twist to his tongue, who opened a bucket shop, comprising the ground floor of a building on the site of which the Mills Building now stands. He had no money, but plenty of cheek. He hung up the rent, bought the fixtures on time, and waited for the market to show fluctuations sufficiently wide for him to suspend. The police of several cities of the United States and Canada are searching high and low for him. This suspension netted him a small amount, and after announcing that he would resume "in a few days," he went over to Brooklyn, hired an office with a ticker or two, and after doing the Brooklyn speculators to their entire satifaction retired to Boston, where a few years since he opened a bucket shop on a great scale of magnificence, and made, according to the stories of customers, over $100,000 in a few months, which he squandered in high living, gambling and fast women. Failing to meet his contracts in Boston he closed up the place, settled with his creditors in time notes and then migrated to Montreal, where he started a shop on the same basis as in New York and Boston, but without the style. He remained in Montreal for several months, and finding that the inhabitants were cold and apathetic and little given to taking flyers with irresponsible persons, succeeded in gouging a few hundreds from under their very eyes and a few weeks thereafter opened a place in Baltimore, where his plausible manner made him many friends, who would esteem it a great kindness to be given his post-office address or to be allowed to go within rifle-shot of him. Returning to New York about two years ago, he succeeded in enlisting capital to a small amount and opened a place on lower Broadway under a borrowed firm name. At this address he suspended payments after every sharp advance or decline in the market. Finally the thing was played out, and he decamped to parts unknown.

A bucket-shop proprietor has built one of the largest hotels in New York from the profits of the past eight years in that business, and another has erected opposite the Produce Exchange, on Beaver street, a business pile eight stories high. The big bucket-shop men are jubilant, and multitudinous little bucket-shop men are looking about for tickers with which to make similar large fortunes,

Underground Systems for New York.

The Electrical Subway Commission of New York continues to receive suggestions from inventors of underground systems. The board room of the Commission on the 6th inst. looked like a tin shop, the broad table being occupied with the two tin plans of the system of Edward Clark, of Jersey City, which is largely controlled by the officers of the Pennsylvania Railroad Company. The system is a combination sidewalk and gutter conduit of cast-iron boxes laid on the edge of the roadway, the outer side forming the curb. The wires are stretched along the line of the curb, and where street crossways are reached the boxes are made with downward offsets, so that the wires need not be bent at sharp angles. Below the boxes for telegraph wires the system provides for a series of vaults or tunnels, in which the electric light and cable wires can be stretched, a system of man-holes with glass covers affording light whenever repairs become necessary.

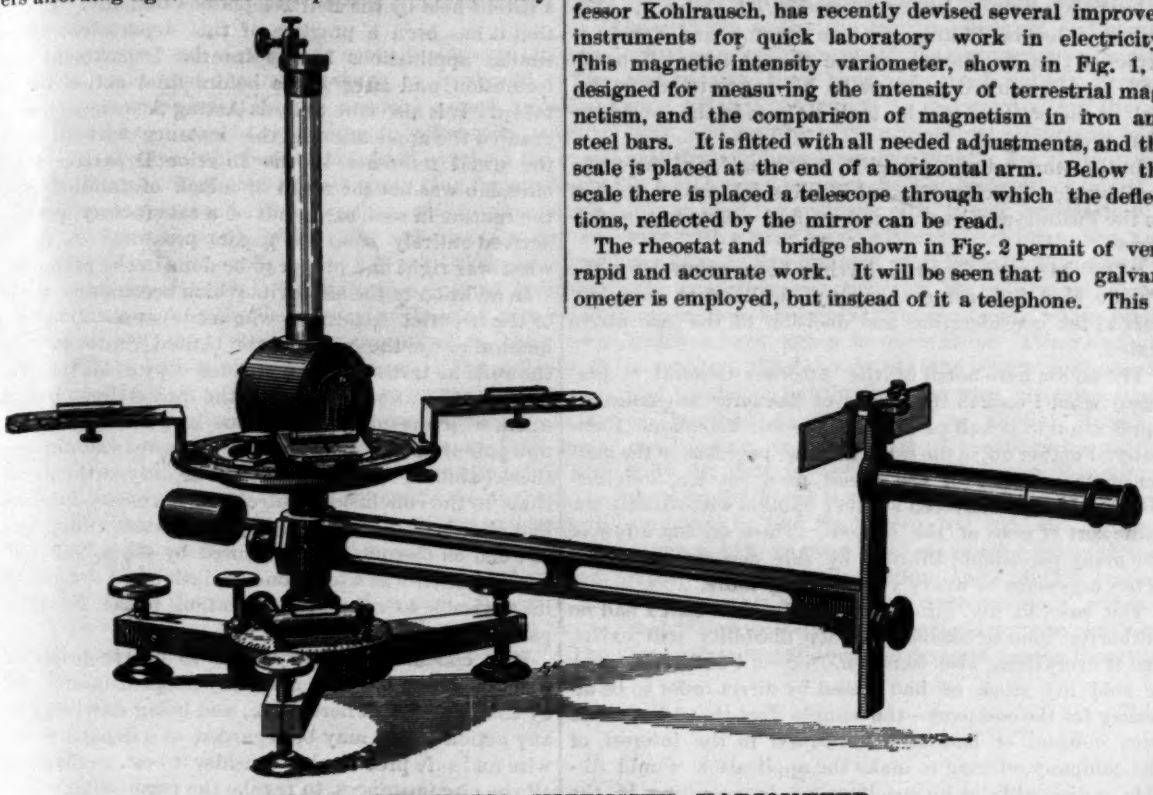


FIG. 1.—MAGNETIC INTENSITY VARIOMETER.

Mr. Clark said that the cost, except for allowance for engineering difficulties, which, he said, included trouble from water and gas pipes, would be, for 3,000 wires, $21,000 per mile. His insulating material is composed of a composition of corundum, and had been tested to 226° Fahrenheit without melting.

Another plan presented last week was that of George M. Cushing, of Boston. It is very simple, and proposes to use the space under the gutter stone for a conduit, which is to be constructed of vitrified pipe, the chamber to be 4 by 3½ feet in size. The advantages claimed by Mr. Cushing for his system include the ease with which any part of the conduit can be reached, and that no vaults will be disturbed in the construction, as the gutter line does not interfere with any steam, water, gas, or sewer pipes, and that it will not require the tearing up of the roadway and thus impede travel. The cost Mr. Cushing estimates at $3.30 per lineal foot.

On the 12th inst. the first hearing was granted to the parties representing the conduit system of George Putnam. This consists of a cast-iron conduit separated by metallic screens, the inventor claiming that in such a divided compartment the induction will take care of itself. The cost per mile of wire was estimated at $22 for 2,000 wires, and $9 per mile for a conduit holding 5,000 wires. The second plan presented was that of the Pennock Underground and Surface Telegraph Company. Mr. J. B. Pennock, who was present, declared that he would be willing to undertake the job of putting all the Western Union and telephone wires in the city underground for $500,000. His system is that of a wooden box, the wood having been subjected to immersion in a chemical compound, the interior of the box to be occupied by the telephone wires strung loosely and then packed in rock wool, a compound of feldspar and lime, which he claims to be moisture and sound proof. The cost for 100 telegraph and telephone wires he guaranteed not to exceed $5,000 per mile, and, including the electric light wires, not over $20,000 per mile. The Asphalt Wrought Iron Pipe Company also presented its system, which is that of a simple thin wrought-iron pipe, lined with asphalt, which Mr. Marcus Marx, the manager, said was the compound which would effectually resist the heat of the pipes of the various steam companies.

Improved Instruments of Professor Kohlrausch.

One of the most celebrated of German physicists, Professor Kohlrausch, has recently devised several improved instruments for quick laboratory work in electricity. This magnetic intensity variometer, shown in Fig. 1, is designed for measuring the intensity of terrestrial magnetism, and the comparison of magnetism in iron and steel bars. It is fitted with all needed adjustments, and the scale is placed at the end of a horizontal arm. Below the scale there is placed a telescope through which the deflections, reflected by the mirror can be read.

The rheostat and bridge shown in Fig. 2 permit of very rapid and accurate work. It will be seen that no galvanometer is employed, but instead of it a telephone. This is placed in circuit with the vibrator or interrupter shown at the left. As long as the balance is not established the click or musical note can be heard in the telephone, indicating a passage of the current. As soon as the latter ceases, however, the sound also dies away. This obviates the necessity of constantly observing a needle, and, with the well-known delicacy of the telephone as a current indicator, makes a very efficient method of observation. The measurements are read off directly on the graduated scale.

FIG. 2.—RHEOSTAT AND BRIDGE.

Fig. 3 represents an improved form of electro-dynamometer with which both continuous and alternating currents can be measured. These instruments have recently been imported by Messrs. Queen & Co., of Philadelphia.

Telephony at the Berlin Telegraph Conference.

The following conclusions with respect to a prospective system of international telephony have been formulated by a committee of the Berlin Telegraph Conference: The contracting States may establish international telephony either by special wires or devoting existing service wires to it. In default of special arrangements, these wires shall go to central stations of the contracting parties, and thence to the individual. The administrations shall agree as to choice of materials and details of service. They shall fix a common rate to be paid for each telephonic line. The unit adopted for the collection of rates is a five-minutes' conversation. The use of the telephone shall be allotted in the order of applications for it, the same correspondents not having it for more than two consecutive conversations of five minutes each, unless no other applications for it are made before or during these conversations. The Conference has also adopted the following rules with regard to telegraphic money orders. Post-office money orders may be sent by telegraph between offices agreeing to adopt that mode. These telegraphic orders are to be treated as private telegrams, and may contain a private message from the sender. Partial repetion is to be obligatory, namely, that relating to names and amounts. The receiving offices shall take such measures as may seem advisable for delivery of the order to the person entitled to it, and for the collection of the cost of carriage beyond the lines.

The United States Suit against the Bell Patent Abandoned.

The suit brought by the United States Attorney-General Garland on the initiative of the National Improved Telephone Company against the Bell patent has been dropped. The following correspondence gives the explanation:

DEPARTMENT OF JUSTICE,
WASHINGTON, Oct. 8, 1885.

THE PRESIDENT—SIR: On my return, the 1st of this month, from a visit to my home, you called my attention to what was being said in reference to the granting of the use of the name of the United States by the Solicitor-General in my absence to test the validity of the Bell Telephone patent. I stated to you then that all I knew about it was contained in the telegram I sent to the *Times-Democrat* of New Orleans, on the 27th of last September, from Little Rock, which telegram will be hereinafter alluded to. Since my return to my post of duty a great deal more has been said in reference to it in public prints and in other ways, and it has assumed a general importance in the country—so much so that I deemed it my duty, upon my own motion, to bring the matter fully to the attention of yourself and the Cabinet at this morning's session, which I did, and explained my attitude in the case, as I understand it, fully. On further reflection I think it best for me to put this statement in writing, so that you may have it for whatever use you wish to make of it and for the benefit of all concerned, and I now proceed to do so.

FIG. 3.—ELECTRO-DYNAMOMETER.

About three years ago I, with six or seven other gentlemen, entered into an organization known as the "Pan Electric Telephone Company," based upon what was called the Rogers invention. We formed that company in good faith, and started in its operations, and have gone on from time to time with it as companies have generally been conducted. In selecting the officers of that company I was made its attorney. The organization was a legitimate and legal one, and one into which each one of its members had a perfect right to enter, and formed at a time when there was not any particular probability that I would ever be called upon to fill the office of Attorney-General of the United States. Some time last summer—I do not recollect the precise day—some gentlemen approached me stating

that they desired to make application in the name of this company, of which I was a stockholder and attorney, for the use of the name of the United States to test the validity of the Bell Telephone patents in the courts. Those gentlemen were Mr. Casey Young, Col. George W. Gantt, Mr. Van Benthuysen, and one other gentleman whose name I do not recollect. I told the gentlemen that I could not consider the matter, and, being asked by one of them why, I stated that I was disabled because of being a stockholder and the attorney for the company in whose name it was intended to make the application. Several questions were propounded to me as to the manner and mode of proceeding in such matters, which I declined to answer, stating that I was disabled from considering the subject matter at all. I could not answer these questions, and this response seemed to be satisfactory to the gentlemen present. They retired from my office and never made any further effort toward an application to me, and I would state that in the interview alluded to they did not exhibit any application to me or say that they were then ready to make it, but that they desired to make it. Whether they wished to make it then or at some future time I do not know.

I heard no more of the matter in any shape. I left here on the 27th of August for a visit of recreation to my home in Arkansas without even speaking to the Solicitor-General or any one else in the office about the matter. And the next thing upon this subject that came to my attention was a telegram kindly sent me by the *Times-Democrat*, of New Orleans—already referred to—to which I replied from Little Rock that I did not know the use of the name of the United States had been granted, and that I had not granted any such use. This is all of my connection with the matter by commission or omission.

After the interview with the gentlemen already spoken of I supposed that they would come to me with an application after the statement I had made, to either refer the matter to the Solicitor-General or to represent it to you as the legal head of the executive departments of the Government for your consideration. Such was not done, but an application was made to the Solicitor-General direct, and he granted the request. Upon this state of facts there is a great deal of misapprehension existing as to my true and proper relation as Attorney-General to this whole subject, and I think I can correct that.

The Solicitor-General, under the law creating that office, is not the deputy or agent of the Attorney-General. He is the officer of the law, and acts as such by virtue of a commission from the people, through the President, and not under the authority of the Attorney-General, in those matters that come before him in the absence, or in the case of the disability, of the Attorney-General to act. The latter part of section 347 of the Revised Statutes says: "In case of vacancy in the office of Attorney-General, or of his absence or disability, the Solicitor-General shall have power to exercise all the duties of that office." The disability here is not limited to the one of physical ability to perform the duties, but has reference to and includes that, as well as mental incapacity or incapacity on account of interest in the subject matter, and the section would properly read, "* * * or of his absence, or, being present, incapacitated to act, * * *" and in cases coming within this statement the Solicitor-General acts for himself. He is not responsible to the Attorney-General, and the Attorney-General can exercise no control over his discretion. So in the case presented, being disabled or disqualified from acting, I, as Attorney General, simply "sat out," as it were, as the reports show that a Justice of the Supreme Court and of other courts does when he has, previous to coming on the bench or otherwise, been connected with a case before the court. This independent character of the Solicitor-General in matters of this sort makes him even a Cabinet officer in the absence of the Attorney-General. [See Elmes on United States Executive departments, section 983.] And this department has plenty of evidence of the former Solicitor-Generals acting in the Cabinet Councils in the absence of the Attorney-General, so that when it came to me that the Pan Electric Telephone Company wanted to use the name of the United States to test the validity of the Bell Telephone patent, I being disabled to act upon it, as heretofore stated, the Solicitor-General was the proper person to act, whether I refered the matter to him, or whether I left the parties (as I did) to seek him or any other remedy as best they could. The fact of my absence is of no moment in this inquiry, because if I was disabled to act and here at the Department of Justice in person the Solicitor-General could act. This appears plain from the reading of the statute, and from the very character of the organization of the Department of Justice, as it is now called.

But, aside from all this, there are plenty of precedents in the departments to enforce this view. In the matter of the Ranche Gaudalupe claim in California, Solicitor-General Phillips gave an opinion to the Interior Department, and at the bottom of that opinion is this note:

"The Attorney-General (Mr. Williams) having been consulted in regard to the above case before his appointment to office, referred the communication to the Secretary of the Interior to the Solicitor-General on the 4th of January, 1873, to answer the questions propounded therein, and took no further action in the matter." (14 Opins. Attorney-General, p. 606.)

Following immediately on in the same volume, in the matter of the Central Branch of the Union Pacific Railway, is an opinion by the Solicitor-General, Mr. Phillips, with a note attached:

"The Attorney-General, previous to his appointment to office, had been employed as counsel in the above case for the railroad company, and for that reason took no official action therein, further than to refer the matter to the Solicitor-General, with a request to answer the questions submitted by the Secretary of the Interior." (Ibid., 607.)

It may be noted here that in this case of the railroad company, as in the Pan Electric Company, the disability or disqualification was on account of having been employed as counsel. Mr. Williams was counsel for the railroad company and felt that he was disqualified from considering the question submitted, and I as counsel for the Pan Electric Telephone Company previous to my appointment to office felt that I could not consider the application or the offer to make an application to me in its behalf.

In the extradition case of Lawrence. (15 Opins., p. 515), Solicitor-General Phillips gives an opinion, and a note is attached that Mr. Pierrepont, the then Attorney-General, had been consulted previous to his appointment in behalf of the petition, and he took no part in the consideration of the subject.

In the same volume, page 557, in the matter of the ocean mail service, Solicitor-General Phillips delivers an opinion to the Postmaster-General, and we find a note to it as follows:

"The Attorney-General, having been counsel for the Pacific Mail Steamship Company, declined to take any part in the consideration and decision of the case above stated."

The action here noted of the Attorney-General is precisely what I took in the matter of the offer to make an application in behalf of the Pan Electric Telephone Company. Further on, in the same volume, page 559, in the matter of the contract for the ocean mail service, Solicitor-General Philips delivered another opinion with exactly the same sort of note at the bottom. These are but a few of the many precedents afforded by this department, and it is not necessary to worry you with any more.

The case, to my mind, is perfectly clear that I had no authority then to consider it. My disability still exists, and if everything else were removed—if I had given away or sold my stock or had ceased by direct order to be attorney for the company—the simple fact that I had once been counsel or had been consulted in the interest of the company offering to make the application would disable or disqualify or incapacitate me from acting in the premises, and I took, as I thought, the most prudent course to have nothing to do with it. And I am still, as the head of this department, the Attorney-General, for these reasons disabled from interfering with it. The only course for me then was not to touch it, and it is the same thing now.

In answering to the question propounded to me at the Cabinet meeting by yourself and others as to the course of procedure governing such matters, I wish to say that there is a custom in this department—not any fixed, adopted rule, but a practice—to have these questions all referred, before they are finally passed upon here, to the department from which the original transaction emanates. There have been a few applications to me since I have been Attorney-General for the use of the name of the United States to test patents for lands, as well as patents for inventions, and I have had them in each case referred to the department from which the particular patent is issued, for information and suggestions, before I acted upon them finally here. Not that any suggestion or advice from that department would be binding or conclusive upon this, but for the sake of a more harmonious and regular administration of the affairs of the executive department, is this custom or practice observed. I do not say that action could not be had by this department independent of this course, but in the few cases that have been before me I have followed this precedent, and within the last four days I have done the same in an application for the use of the name of the United States to test a patent for an invention. Very respectfully, your obedient servant,

A. H. GARLAND, Attorney-General.

II.

EXECUTIVE MANSION, WASHINGTON, Oct. 8, 1885.

The Hon. John Goode, Solicitor-General:

MY DEAR SIR: I submit to you with this a statement made by Attorney-General Garland explaining his relations (or rather want of relation) to the action taken by you in his absence upon an application to bring in the name of the United States a suit to test the validity of a patent held by the Bell Telephone Company. I call your attention especially to the latter part of this statement, in which the Attorney-General speaks of the usual procedure in the Department of Justice upon such applications. The reference to the Interior Department, which he mentions as an ordinary feature in that procedure, seems to have been dispensed with in your treatment of this application. This omission may have been the result of a lack of familiarity with the routine in such cases, or of a perfectly clear and satisfactory persuasion of what should be done derived from the documents presented to you. Whatever the cause may be, and while such reference is not vital, of course, to the validity of your action, and though I am by no means prepared to question the correctness of the exercise of your discretion in the matter, still the precedent calling for a reference to the department with which the matter is connected is so well established, and seems to me so well founded upon considerations of safety, as well as propriety, that I desire to suggest for your reflection the proposition whether such action on your part as will preserve and protect such precedent and custom could not well be taken. Yours very truly,

GROVER CLEVELAND.

III.

DEPARTMENT OF JUSTICE, WASHINGTON, Oct. 9, 1885.

The President:

SIR: I have the honor to acknowledge the receipt of yours of the 8th inst., submitting a statement made by the Attorney-General with reference to the action taken by myself in his absence upon an application to bring in the name of the United States a suit to test the validity of a patent held by the Bell Telephone Company. It is true that it has been a practice of this department to refer similar applications to the Interior Department for information and suggestions before final action has been taken. It is also true that, as Acting Attorney-General, I granted the application in this instance without making the usual reference to the Interior Department. This omission was not the result of a lack of familiarity with the routine in such cases, but of a satisfactory persuasion derived entirely from the papers presented to me as to what was right and proper to be done in the premises.

In addition to the affidavits which accompany the letter of the District Attorney, who made application for permission to use the name of the United States in bringing the suit, he transmitted an attested copy of all the writings filed in the Patent Office and the proceedings had there upon, which resulted in the issue and delivery of the letters patent to Mr. Bell. After a careful examination of these exhibits, which appeared to be duly authenticated, I came to the conclusion that all the necessary information had already been furnished by the Patent Office, and inasmuch as the question presented by the papers for my consideration was a legal one exclusively, I did not deem its advisable to refer the application to the Interior Department for suggestions.

But, concurring with you as to the propriety of the practice which has been generally adopted in such matters by this department heretofore, and being unwilling to take any action which may be regarded as a departure from a wise and safe precedent, I consider it best, perhaps, under all the circumstances, to revoke the permission which has been granted to bring the suit referred to. Accordingly I have written by to-day's mail to H. W. McCorry, Esq., United States Attorney for the Western District of Tennessee, directing him to discontinue the suit which he was instructed to institute in the name of the United States for the purpose of vacating and annuling the letters patent issued to Alexander Graham Bell on the 7th day of March, 1876, and numbered 174,455. Very respectfully, your obedient servant,

JOHN GOODE, Solicitor-General.

Electric Lighting in England.*

Mr. Preece, electrician to the Post-Office, delivered on Monday an address to the British Association, which, if not specially interesting or instructive, may serve to remind us all of a curious episode in the history of discovery. It is now twenty-five years or more since Mr. Swan—then, we believe, a chemist—patented an electric lamp possessing all, or nearly all, the merits now claimed for the electric light, and very much better adapted for general use than the majority of the lamps which have created such excitement. The time was not ripe, and Mr. Swan's discovery fell still-born, when a few years ago Mr. Edison, of New York, startled the world with the announcement that he had solved the secret of electric lighting. Mr. Edison was one of those men who are, as it were, the converse of unsuccessful discoverers—one of the men whom the world, before they have spoken, is determined to hear. All Americans are believed in England to be inventors from their cradles. Edison was held in the United States to be the Grand Inventor, and he actually had invented the most surprising, though the least useful, of all modern instruments, the phonograph. He had made an instrument which could report a speech and imitate the speaker's voice. The English people, therefore, believed in him at once, sold its gas shares in a panic at a loss of 20 per cent. on their value, and expected breathlessly the immediate lighting of all cities—it might be, said the sanguine, through artificial suns suspended four hundred feet above each town; and of all houses, it might be, said the same persons, through invisible lights at inappreciable expense. Since that period the progress of improvement in the light has been fairly steady. The electricians have got rid of a shake or quiver in the light, owing to intermittent supply, which made it at first painful to the nerves; they have changed the intolerable whiteness of its radiance into a soft yellowness—have, in fact, changed moonlight into sunlight; and they have overcome most of the original mechanical difficulties, such as transmitting the light to a distance, increasing and decreasing it at will, and selling it by measure, which can be exactly ascertained, instead of by time, which cannot be ascertained with the same precision.

* *London Spectator*, Sept. 19, 1885.

They have, in fact, made the light quite ready for use, and to a considerable extent it is used. Slowly, but surely, it defeats gas in all buildings where a great body of light is required, or where it is advantageous that the light should be of a certain perfectness, especially for the acurate revelation of shades of color. The popularity of the light has not diminished, the wish for it has increased, while the belief in it has so developed that if a public demand were certain, millions would be instantly invested in its diffusion. One would hesitate to place a limit on the sums which, if there were even a fair chance of a moderate return from electric lighting, would be instantly forthcoming to light up the cities of the world. The light, apart from its merits, has a hold on the popular imagination; it is the light behind which there is no other, which can never be superseded; and there is a notion, not in the least justified by experiment, but quite ineradicable, that some day or other it will be cheaply produced—a notion probably due to the fact that nobody pays for the batteries which produce lightning.

Nevertheless, electric lighting scarcely advances in general use, or at least does not advance as it should. The companies which sell it do not prosper, except occasionally, by selling the right to use hopeful patents in specific localities at prices which, from the first, overload the local undertakings. The cities are not competing for contracts with the companies. The parishes which have made contracts give them up, and display sometimes a coy reluctance to be quite explicit as to the sums they have lost upon their experiments. The managers of great buildings are not all adopting the light with the decision and rapidity which, if they were quite convinced in their own minds, the world would expect of them. The holders of gas shares hold on to their shares as to most valuable properties, and are inclined after dinner to mock audibly at the electricians; though, if the listener happens to hold such shares himself, he will detect a faint shade of lingering fear in those mockeries, and a disposition to be fluent about the residual products of gas and the value of gas as a heating agent, and the necessity of gas to create the force which develops electricity, even if the new light should succeed. Such failure in the very moment of success, though it has happened before, is a little unusual; and one would like to know with some precision what is its explanation. The managers of companies will tell inquirers in a moment, and with a pleasing air of certainty, that the explanation is simple—that it is all that terrible Mr. Chamberlain, and that he ought to be shocked to death at once by mammoth batteries, as the fitting but too easy penalty of his conduct in stealing electric profits for the public. But, then, is all that quite true? Mr. Chamberlain is a dreadful person, no doubt, and is not as clear as he should be in his ideas as to the indefeasible right of corporations and patentees to plunder the community; and he did, being an old hand at bargains, make rather hard terms for the State; but still, Mr. Chamberlain is not the State himself. One has a notion that if Birmingham wanted electric lights, and were shown that Mr. Chamberlain were the obstacle, and thereupon remonstrated in audible fashion, Mr. Chamberlain would be quite gentle, and the obnoxious clauses would, without much flourish of trumpets, be induced to take themselves away. Birmingham does not stir in that direction, that we see. Moreover, there are, say, a thousand houses in England where the Act would be no obstacle, where the light is ardently desired, where gas is despised and hated, and where the dread of fire from oil-lamps overset and candles carelessly handled is never extinct; yet these houses, whose proprietors care practically nothing about cost, are not lighted with the electric light. Something seems to intervene between it and the wealthy public; and we should like to know what it is. We believe the causes of failure outside great cities are just two, and they are both due to the companies and both removable by them, being simply greed and ignorance. Those who want the light cannot supply it for themselves—as Mr. Preece, being an experienced electrician, does—but must rely on experts, and the experts can do nothing because, first of all, of the huge cost of interfering with patent rights. Mr. Preece says his only mechanician for lighting his house is his gardener; and though that is not true, for there is Mr. Preece himself, with his knowledge—for which, when supplying his own house, he does not charge—still it is true that Mr. Preece could in a week impart enough cram-science to a decently clever plumber to enable him with a fair-sized gas-engine to manage, say, half-a-dozen houses. No act at all would be required, for no privileges would be wanted; and the plumber would do it and gain a small annuity for himself, but that the patentees would interfere, and with their ruinuous charges destroy all hope of profit. They want to keep the work to themselves, and do not perceive that a charge for instruction and a small royalty would pay them a great deal better than the neglect they now suffer under. Set the big enterprises, such as lighting whole cities, aside for a moment, and think of little matters. The villages and single houses want the light much more than the cities do, and no one doubts that if village artisans could give it at reasonable prices the people would pay the money; and what is the obstacle? Mr. Preece says there is none but ignorance. Once taught how to do it, his gardener, with a gas-engine, can keep the light supplied to his house at an expense, as far as we understand him, of a about 16s. a year per lamp. Increase that amount to £1, and so leave a profit for the mechanic, and it would be gladly paid all over England. Yet nobody can or will go into a trade which might be so widely diffused, because it would be so costly to buy the companies' rights, and because the "first expense" is made by the companies so considerable, and because they have instructed nobody except their own officials. There is no mystery about the electric light, and nothing in its management which an instructed gasfitter could not learn in a month; yet there is nothing in which small experiment is so difficult, or about which it is so hard for ordinary men to get information. If a man with a large house wishes to burn forty colza lamps, he can learn in five minutes what his expenditure will be; but if he wants forty electric lights, the only information he can acquire as to his expenditure is a feebly vague statement, which at once, unless he owns Eaton Abbey, induces him to recede. Why should not the exact method and cost and trouble of lighting a house with electricity be made as familiar to the public as similar details about gas lighting, and hundreds of gasfitters be taught carefully all that is needful for that new development of their trade? There is no need to teach them science. They are not to be like Mr. Preece, but like Mr. Preece's gardener, able to go round and set small engines at work and repair wire fittings in separate and ordinary houses. The companies are too greedy and too pompous, and do not see that if little groups of houses could once be easily supplied by ordinary tradesmen the demand for the thing they sell would become almost limitless. People would become habituated to their light, and as it is the best and most convenient, would soon be discontented with any other.

F.G. 1.—DOUBLE BURGLAR ALARM WINDOW SPRING.

FIG. 2.—BURGLAR ALARM DOOR SPRING.

Double Burglar Alarm Window Spring.

Among the recent improvements in burglar alarm window springs is that shown in our engraving, Fig. 1. It is designed to be operated by both the upper and lower sashes of a window. It is fastened to the dividing strip midway between the two, and the movement of either causes the corresponding cylindrical projection to be pressed inward. This closes the circuit and sounds the alarm. This double alarm is manufactured by Messrs. S. H. Hoggson & Company, of Bridgeport, Conn., who also make an improved burglar alarm door spring, shown in Fig. 2. The spring is mortised into the door casing, and the brass cup is inserted into the edge of the door, and so placed that when the door is closed the cup will push the pin in sufficient to break the circuit. The opening of the door releases the pin which holds the spring back, and allows the latter to make contact and close the circuit. The cup protects the pin so that it is impossible to hold the latter by inserting a knife blade, and thus preventing an alarm when the door is opened.

Death of Mr. John Muirhead.

We regret to record the death of Mr. John Muirhead, at his residence near London, on Sept. 17. He was born in Scotland in 1807, and was connected with telegraphy from its earliest days in England. He joined the original Electric Telegraph Company in 1846, and remained in its service till 1870, when it was transferred to post-office control. During all that time he was continuously occupied in telegraphic work, and introduced many valuable improvements. He also helped to found and carry on the celebrated firm of Latimer Clark, Muirhead & Company. The cable duplex system is the invention of his sons, who inherit worthily the honorable traditions of a distinguished name. A few years ago, Mr. Muirhead retired from business, and then until his death, devoted his well-earned leisure to the study of history, a favorite amusement of his. Our English contemporaries speak very highly of the deceased, and mention many interesting little features in his career and character, showing him to be one of the most estimable of the telegraph pioneers, of whom so few alas! are left to day.

Suggested International Cable System.

The *Times* correspondent at Berlin communicates the contents of a very important letter from Sir James Anderson to Herr von Stephan. Sir James Anderson sketches out a scheme, already outlined by us, for the taking over by the Governments of the world, by means of a great council representing the nations of the world, of the cables owned by the submarine cable companies. In an interesting paper which he has had compiled, he points out that the twenty-six cable companies own a total length of 98,450 miles, their capital being £34,459,089, with a reserve fund of £3,148,695, and gross annual revenue of £3,477,082, and their percentage of dividends as follows: Anglo-American, 3¼; American Telegraph and Cable, 5; Black Sea, 4; Brazilian Submarine, 6; Télégraphe de Paris à New York, 4; Central American Cuba Submarine, 8; Direct Spanish, *nil*; Direct United States, 5; Eastern, 6; Eastern and South African, 8; Eastern Extension, 7; German. Norwegian, 5½; German Union, 8; Great Northern, 8; Hamburg Heligoland, *nil*; Mexican (no information published); Montevidean and Brazilian, *nil*; Platino-Brazileia, 1¼; River Plate, 15; Submarine, 14; West Indian and Panama, *nil*; Western and Brazilian, *nil*; West Coast of America, 4. Sir James Anderson does not desire a continuance of cable contests. He says that if the Governments of the world take over the cables, the number of lines of communication can be increased to any desired extent, and the tariff reduced to any figure, so as to make "the foreign trade of the world an extended home trade," common alike to all nations. For this end the proposal is that the maritime States, or all the States in some agreed proportion, should guarantee a moderate interest upon the present capital of the companies, and take over and work the cables by a telegraph board of management. It is not to be thought of that Great Britain or any one or two States should buy up or control the cables, because there are concessions granted to companies which would not be given to foreign Governments, and there are jealousies among States as well as among individuals. No plan will come to any practical result unless it is international, and it is not thought that any great difficulty will be experienced in formulating some plan if the principle be accepted. It would cost the nations of the world no money, and all the increment could go to the extension of cables and the reduction of tariffs. It is believed that Herr von Stephan is in favor of this proposal.

Electricity at the Hell Gate Explosion.

In the blowing up of Flood Rock, in the East River, on Saturday last, electricity played quite a prominent part. Not only was the firing of the mine accomplished by it, but it was also called upon to aid in various observations made upon the effect of the explosion. In the mine there were 600 fuses connected in 24 circuits, which were joined together at their ends, and immersed in two mercury cups with a battery in circuit. A wire connecting these two cups was held out of contact with the mercury by a string upon which a fuse was fastened. This fuse was connected with the shore by wire and separate battery and key. Upon depressing the latter, the current passing through the fuse ignited the latter and burnt the string holding up the connecting wire between the two mercury cups. This closed the circuit of the main battery through the 24 circuits, and the explosion followed instantaneously. The electrical apparatus was furnished by Messrs. E. S. Greeley & Co., of this city, under the supervision of Mr. M. W. Goodyear, and according to the Government specifications. These called for a battery having an E. M. F. of 2 volts and an internal resistance of $\frac{4}{100}$ ohm. The key carefully selected for this important work was the one known as the "Victor," made by the firm. The battery consisted of 60 cells, bichromate, in 12 troughs of 5 cells each.

As stated above, observations were taken for the purpose of noting the effects of the explosion, first, upon the vibrations of the earth, and, secondly, upon the water. In the first instance a number of observers were placed at various points widely apart, and connected by telegraph wire through the firing key already mentioned. At each of these stations a chronometer was placed, and by this means notification of the exact instant of the explosion

was transmitted, so that the rate of travel of the concussion was determined.

The closing of the key also operated the shutters of ten cameras which took instantaneous pictures of the enormous volume of water, which was raised to a height of over 200 feet. The cameras were so arranged that the shutters were dropped at intervals of one second each, so that a continuous record was obtained. All the electrical arrangements operated admirably, and the event was a success from every stand-point—one upon which the officials and other persons concerned deserve hearty congratulations.

The New England Telephone Rates.

The following information regarding the rate war appears in the Lowell *Courier* of the 10th inst.: A meeting was recently held at Haverhill, the attendants being mostly grocers and provision dealers. There was a free interchange of views, and, while there was no spirit manifested to attempt to coerce the company to retain its recent rates, there was a general feeling that the service would not be worth the increased tariff, and that if all in any special line of business had the instruments removed it would result in no injury. In order to secure a more general feeling of those who take the service, another meeting was decided upon and a committee was appointed to notify subscribers. In Salem the telephone revolt is reported as spreading and growing more pronounced in character. It is felt there that the telephone company is holding untenable ground. At Lynn a large number of withdrawals nave been made. At Manchester, N. H., all the druggists of the city who have telephones at their places of business, fourteen in number, have signed a paper notifying the telephone exchange to remove the instruments before the 15th inst. if their rates are increased. Three of the number have already given such notification. At Concord, N. H., there were in operation 232 instruments, of which about half the number of users signified their intention to withdraw. At. St. Albans, Vt., subscribers have withdrawn to such an extent that there are but few left. In this place the grievance is not only an advance in rates, but extremely poor service. A "public station" is to be maintained at St. Albans for out-of-town communication, which it seems from the local press is about all the use there is in that town for the system.

The Southern New England Telephone Company have also been having a war with its patrons. At Greenwich, Conn., there is bitter complaint, and many instruments have been ordered out. In that section it is said that the service is miserable, and that there are exceedingly high rates, which have been increased each year since 1882.

It is proposed by several users of the telephone system in a little square down town in Lowell to order their instruments out, with the exception of one of their number, and then all, together with other traders in the vicinity who have never had telephones, use this one telephone, paying every time they make use of it, and making some arrangement of compensation with the person in whose store it is located.

Remarkable Occurrence During a Thunder-storm.

As a demonstration of the curious freaks of lightning, the experience of Mr. J. Bedford Elwell, communicated to the British Association, is of interest. That gentleman's residence is situated at Albrighton, ten miles from Wolverhampton, with which it is connected by telephone. The house, which is lighted by electricity, has a lightning protector 25 years old. The telephone wire very improperly makes earth on this conductor. He says:

The storm was at its height about half-past eight in the evening, and we had just retired to the drawing room, there being only a single lamp left alight in the dining room, in the centre of the corona. The telephone bell was sounding with every flash of lightning, when suddenly a report like a rifle shot was heard in the hall, and at the same instant the servants in the dining room were plunged into darkness by the lamp in the corona flashing up and then going out (another lamp was immediately put in, showing the leads were not injured); also, at the same moment, the telephone wires were both fused. The wire sometimes used to connect the telephone with the drawing room was also fused, and through it the lightning tried to make earth (or *vice versa*) all over the electric light system, succeeding in one place, in a bedroom over the entrance hall, where a bell-pull was close to one of the leads. The current struck across, showing an E. M. F. of many thousand volts, and fused the bell wire. None of the lead cut-outs were fused on any of the wires.

'On examining the burnt lamp in the dining room, it was found to be so blackened that (although it was perfectly clear and bright the moment before, and being a 48-volt Swan lamp, could not be overrun from 24 cells) it was with difficulty that the filament could be seen. It was burnt off at *both ends* where the platinum wire joined, and *lay entire* in the bottom of the globe. A few globules of melted glass or platinum were also rolling about within the globe.

The glass globe has become a beautiful mirror by the fine particles of platinum that have been projected against it.

A *separate earth plate* has since been put to the telephone, so that nothing of the kind can again happen.

An Englishman on American Electric Lighting.

It is always interesting to read the accounts of foreigners who have visited this country, and, returning home, have given their impressions for the benefit of their benighted countrymen. The latest instance of this is the account which Mr. Chas. Lever, of England, publishes of his recent visit to the United States. Mr. Lever is a keen, bright critic. Among numerous remarks he has the following:

"The arc lamps supplied for advertisement outside the various stores, theatres, saloons, etc., are strung up very carelessly—so much so, that if we were to put them up here in the same manner the probability is that a policeman would request us to take them down again. The Americans, however, are an intensely practical people; and so long as they get the light they are satisfied."

The last sentence quoted is perfectly true—we want the light. But we have still to hear of an accident which was due to the careless stringing of a lamp. Although our lamps may be hung without regard to æsthetic taste, we deny that they are *carelessly* strung. Again, in commenting on the electric lighting of New York City, Mr. Lever draws attention to the "rather amusing feature in connection with this supply system," and which consists in the fact "that whether a 10-ampère or 20-ampère current is used, the same conductor is employed, generally a No. 4 (American gauge) copper wire, covered with cotton." This feature which strikes Mr. Lever as so "amusing," has its serious sides, nevertheless. The question involved here is not one of the size of wire which will carry the current safely, but that which will carry it most *economically*. Where the arc light circuits aggregate hundreds of miles in length, as they do in this city, the resistance of the line becomes an appreciable factor, and to reduce this as low as possible is evidently desirable. Experience has shown that, with a No. 4 wire, long circuits can be worked more economically (on account of the increased number of lamps they will carry) than those of No. 6 wire, and notwithstanding the reduced cost of line of the latter. We may add, however, that the Brush Illuminating Company use a No. 6 B. W. G. wire on their circuits, which is practically equivalent to a No. 4 B. & S. We are informed, also, that in the light of the experience gained, it would have been more economical to have put up even larger wires than those now used.

Electric Measuring Apparatus.

In the *American Journal of Science* for March, Professor Trowbridge describes a form of differential cosine galvanometer, in which the action on a magnet of a strong current, moving through the fixed vertical circle of a large tangent galvanometer (of one metre radius) is balanced by the opposite effect of a weak current from a Daniell cell moving in a reverse direction through the coil of a cosine galvanometer, the fixed and movable coils having a common centre. By moving the coil of the cosine galvanometer about its horizontal axis, it is easy to secure a balance and thus to determine the magnitude of the strong current. An obvious and simple modification of this apparatus, says Prof. Chas. R. Cross, in a communication to *Science*, consists in substituting for the cosine galvanometer an ordinary tangent galvanometer, with a coil of small radius having a number of turns of wire in circuit with a battery and rheostat. By varying the resistance in the circuit, a balance can be reached, and the strength of the current found. A mirror galvanometer thus arranged, and in direct circuit with a battery and very high resistance, or in derived circuit with a battery and tangent galvanometer, might sometimes be useful, as in studying slow variations in strong currents. Another instrument which is likely to prove valuable for measuring strong currents is a new form of differential cosine galvanometer, recently devised by Mr. R. H. Pierce, while a student at the Massachusetts Institute of Technology. The current is caused to pass in opposite directions through two concentric circles of nearly the same radius, as in Brackett's differential galvanometer; but the inner of these is capable of moving upon a horizontal axis, as in the ordinary cosine galvanometer, and it is revolved until a convenient deflection is secured. A simple formula then gives the strength of the current.

"A New Galvanic Cell."

BY D. H. F.

It seems to me that the cell described by Prof. A. E. Dolbear under the above heading in THE ELECTRICAL WORLD of Oct. 10, closely resembles the one described by Mr. Latimer Clark (see Jenkins' "Electricity and Magnetism," edition of 1873, p. 227), and used by the United States, Gold & Stock, and other telegraph companies many years ago, and then known as the "Electropoion" battery. The only difference is, that in the latter sodium chloride is used instead of ammonium chloride, which, with the other materials named, would give about the same chemical action, be cheaper, and, I judge, better, because the E. M. F. of this cell is 2 volts or more, while that of the one described in the article referred to is given at 1.1 volts.

Some of the manufacturers of electro-medical apparatus describe the mixture of bichromate solution with nitric acid in their directions for making solutions for "cautery" battery.

An E. M. F. of 2.3 volts from a single cell is not unprecedented. In 1879 the writer made a cell in which the positive element was sodium amalgam immersed in a strong solution of caustic soda; the negative element was carbon in liquid chloride of iodine. The E. M. F. of this cell was about 4 volts. It was too expensive for practical use.

Electrodes for Primary Batteries.

In a new English patent relating to electrodes for primary batteries, the inventor, T. Rowan, employs a base of carbon or other unoxidizable substance, which is coated with spongy metal, lead, copper, iron, etc., which may be mixed with finely-divided powder. The carbon base may be in the form of laminæ, or of an open frame-work. The metal may be electrically deposited, or an alloy of two metals may be applied to the base, and one afterward removed chemically or electrically.

We may also mention an electric alarm pressure gauge just patented in England. In this, the pointer of the gauge is fitted at each end with platinum springs, which, through segmental insulated platinum pieces on the dial face, complete the circuit of a battery (having a bell in line) when a certain pressure is attained. When the index pointer is in metallic connection with the casing of the gauge, one wire of the circuit may be joined directly to the casing.

The Fairy Tale of Science.

At Sir Titus Salt's Girls' Schools, near Bradford, England, a dramatic piece called "Midsummer Night's Fancy," written specially for the occasion, was performed recently. In the first scene the Fairy King protests that the sciences at the present epoch are driving out all the belief in fairy law. Oberon informs his subjects that mankind, having ceased to believe in fairydom, there was nothing for the fairies but to retire from this world. After some protests the figure of the Nineteenth Century, decorated by the locomotive and steam launch and bearing on her head a brilliant electric light, comes forward. The Fairy King asks the Nineteenth Century to abandon the sciences of the present time and to rejoin the fairies. The Nineteenth Century summons her own subjects—Mathematics, Mechanics, Steam and Electricity—the latter figure bearing another large flashing electric light upon her forehead. With these figures were Imagination, Fancy, Magic, Witchcraft, and each makes out a case for her own existence. The Sciences win the day, and Oberon bids farewell to the world. The dresses and scenery were most brilliant. The electric apparatus was made by Messrs. Woodhouse & Rawson, of London, and was most effective.

REVIEWS OF NEW BOOKS.

ELECTROLYSIS: A Practical Treatise on Nickeling, Coppering, Gilding, Silvering, the Refining of Metals and Treatment of Ores by Means of Electricity. By Hippolyte Fontaine. Translated from the French by J. A. Berly. New York: 1885. E. & F. N. Spon. 256 pp. Price, $3.50.

The comprehensive subject of this work is one upon which various writers have given us excellent treatises, not only in the English, but in the German and French languages. Notwithstanding this, the present book is of great value, as the subject is broadly considered and treated in a manner which we have not heretofore seen followed out to the same extent. The aim of the author is not simply to give directions regarding manipulation and minor details, but to aid the experimenter in devising the most economic methods to pursue, by giving the rationale of the various processes. In order to carry this out, the book is divided into four sections, the first of which is devoted to the theoretical consideration indispensable to experimenters who wish to understand the electrical phenomena which they are daily witnessing. This part of the book can be easily understood by practical men, consisting as it does of only very simple formulæ and elementary calculations, with a series of tables on conductivity, electro-chemical equivalents, the heat generated by the formation of compound bodies, and the limits of electrolysis.

The second part deals with the principles, batteries and dynamo machines used in electro-chemistry. Electro-deposition, nickeling, gilding, silvering, coppering are treated of in the third section, special prominence being given to nickeling. The last section of the book relates to the refining of metals and the treatment of ores. In the latter considerable space is devoted to extraction of pure copper by electro-metallurgical processes. The rising importance of this industry makes it of special value.

The book is printed in clear type and well illustrated, and we can recommend it as one of the best of its class for the student as well as the practical worker.

ANLEITUNG ZUR ERRICHTUNG UND INSTANDHALTUNG OBERIRDISCHER TELEGRAPHEN UND TELEPHON LINIEN AUS LAZARE WEILLER'S PATENT SILICIUM BRONZE DRAHT. By J. B. Grieff. *Vienna: L. W. Seidel and Sohn.*

The increasing application of silicious and phospor, bronze wires for telegraph and telephone purposes makes the appearance of this little volume a very timely one. It gives full tables regarding the strength, resistance and other important properties of these wires, which have been introduced by M. Lazare Weiller. Silicium bronze according to these, possesses undoubted valuable qualities. Thus we find that taking the conductivity of copper as 100, that of the best quality of silicon bronze—telegraph wire A—is 97, while that of phosphor bronze is

26; that of Swedish wrought iron 16.5, Bessemer steel 16, and patent cast steel 10.5. On the other hand, the breaking strain in kilos. per square millimetre is for copper only 28; but for silicon bronze telegraph wire A, 45. Where, again, great strength is more essential than high conductivity, there is a grade of silicion bronze wire, "special telephone B," which has a conductivity of only 20, higher than any iron or steel; but its strength is 112.5, as against 95 for patent cast steel. Hence, silicon bronze can be obtained considerably stronger than any other kind of wire or rod, and still more conductive than any save pure copper and phosphor bronze.

Another important table gives a comparison between the weights of the various kinds of iron and steel wires per 1,000 metres run, and those of silicon bronze wires capable of being used in their stead. It will be found that the iron and steel range from three to nearly six times the weight of an equivalent quantity of silicon bronze. In addition, the book contains full directions for the handling and erection of the wire, and hence will be a valuable aid to those intrusted with such work.

NEW ENGLAND NOTES.

HARTFORD, Conn., Oct. 10, 1885.

The Mather Electric Light Company are doing a very good business, being in receipt of numerous orders for the installation of their system of electric lighting in New England cities and towns, and elsewhere. As evidence of the fact that this company's system is meeting with success, the following presents a showing of the plants now being installed, viz.:

	Incandescent lamps.
Thornton Worsted Mills, Providence	150
Carolina Mills, Carolina, R. I.	50
Atwood Machine Works, Stonington, Conn	190
Whitcomb Envelope Works, Worcester, Mass.	100
Hall Rubber Company, Watertown, Mass.	50
Cheney Brothers' Manufactory, Manchester, Conn.	100
Agawam Paper Company's Mills, West Springfield, Conn.	50
Wachusetts Electric Light Company, Fitchburg, Mass.	150
American Mills, Rockville, Conn.	100
Worthington Hydraulic Works, Brooklyn, N. Y.	100
	Arc lights.
Philadelphia Underground Electric Light Company, Philadelphia	100

Many of the purchasers of arc and incandescent plants heretofore installed by the Mather Electric Light Company, to some of which reference was made in THE ELECTRICAL WORLD of Aug. 15, have recently increased the number of the lights—same system—each order being prefaced with complimentary comments on the efficiency, steadiness and other satisfactory results obtained from the lights previously furnished by the Mather Company.

Mr. Dwight Slate, of Hartford, Conn., designer and builder of special and automatic machinery, reports improving trade. His sensitive drills for light work are well known among manufacturers of electric appliances, and the improvements lately added to this line, by the production of No. 2 improved single spindle, and the three-spindle sensitive drills, are being appreciated by manufacturers. The Thomson-Houston and Mather electric light companies, for instance, both of whom use several old style drills, have placed additional orders for new styles during the past month. The addition of devices for foot feed, and for centering shafts, together with the excellence of workmanship, are giving this drill a high place in its special line of usefulness. Another evidence of Yankee ingenuity is Mr. Slate's new automatic attachment to printing presses. It enables the makers of postal cards to print them from endless rolls of paper. The attachment is applied to the press and, taking the roll as printed, cuts, counts into packs of 25, puts paper band around each pack, gums it, and after registering its number on an automatic counter, throws out the pack ready for boxing. A third novelty is the automatic gear-cutter for cutting chuck racks in all the varying sizes. It was designed on solicitation from Pratt & Whitney and the E. Horton & Son Chuck Co., for whom machines were built. It has lately been patented by Mr. Slate.

The Schuyler Electric Light Company are to-day standing prominently before the public as owners of a highly efficient system of both arc and incandescent lighting. The business of the company is steadily increasing, and it is pleasing to see the daily rush and activity in their immense factory. During the past few weeks the company have been engaged filling orders for the following:

New 100 arc-light plant at Elizabeth, N. J.
" 100 " " " Columbia, Pa.
" 75 " " " Skowhegan, Me.

They have added 50 arc lights at Middletown, Conn., the city authorities having ordered out all the gas and oil street lamps formerly in use, and have also added 58 arc lights at New Britain, Conn., the number previously installed on trial being only 17. The first installation of 17 lights had been running but 30 days, and during that time the municipal officers subjected them to all manner of tests, only to become more thoroughly satisfied with the system, and they then and there ordered out all the gas street lamps and instructed the Schuyler Company to put in the additional number above mentioned. At Danbury, Conn., the company first installed 75 arc lights, a portion of them on towers, and the citizens were so well pleased with the system that orders have been given to increase the plant to 125 lights.

On the first instant, Mr. A. H. Eddy, the sole manufacturer of the Mather dynamo electric machine, transferred his entire business interests to a joint stock corporation, having the title of The Eddy Electric Manufacturing Company, capital $10,000, with Mr. Eddy as president.

Your correspondent had the pleasure of meeting for the first time with Mr. W. J. Sumner, who was likewise making a sojourn in this city. Mr. Sumner is the traveling representative of the Amherst Hydraulic Motor Co., of Holyoke, Mass. The ingenious and useful apparatus now being placed in the market by the above-named company is attracting a great deal of attention throughout New England, and wherever it has been introduced. It is designed to run dental and sewing machines, coffee mills, and light mechanical work, and is especially adapted for organ-blowing. Mr. Sumner says that his company have recently made several satisfactory experiments with the Amherst motor in running small dynamos, and that the fact has been clearly demonstrated, that for isolated electric lighting this motor possesses all the requisities that could be desired.

The Hartford Electric Light Company have a well-earned reputation for having one of the best arranged and most thoroughly systematized plants in this or any other country. Disinterested persons who have examined the entire plant—its equipment, wiring and poles—have pronounced the highest encomiums upon the evidence made manifest of the enterprise and good taste of the company, and the liberal expenditure of money, which has resulted in giving to the citizens of Hartford an electric lighting system which attracts the attention and elicits the admiration of strangers, and is referred to with pride by the two prominent electric light companies who first contributed to its installation.

The American Electric Illuminating Company established this plant in the spring of 1883, and shortly afterwards sold out to Hartford capitalists. The system of arc lighting used is that of the Thomson-Houston Electric Company. They have 8 dynamos (another soon to be added) 4 Armington & Sims engines, and one other engine built by the New York Safety Power Company. The latter was put in merely as an experiment; but it has done its work in a manner highly satisfactory to the owners and engineer of the plant, and it will remain as a permanent fixture. The number of arc lights at present in use, city and commercial, is a little over 300; but an increase of 50 more will be made before the end of this month. The wiring for the lights, it is claimed, extends over a contiguous distance of five miles, and the wires are strung on handsome iron poles; the latter costing the company from $7.50 to $35 each. The officers of the Hartford Electric Light Company are: President, A. C. Dunham; Vice-President, H. M. French; Secretary and Treasurer, Howard M. Clark; Superintendent, F. A. French; Electrician and Engineer, H. H. Johnson. The capital is $100,000. In conclusion, it is fitting to state that this plant has proven a good paying investment, three dividends having been declared during the present year, March, June and October, of 1½ per cent. on the entire capital stock.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Oct. 9, 1885.

The Town of Lake Electric Light Company has been organized. The Chicago stock-yards are located in this town. This company has purchased dynamos and lamps from the Western branch of the Thomson-Houston Electric Company for 130 arc lights, also two Ogden engines from the Ogden Engine Company, Chicago. The plant will start off with 100 lights, and will soon be increased to its full capacity, it is expected.

The Chicago house of the Thomson-Houston Company has just sent a 25-light arc machine to Peru, Ind.

The Thomson-Houston Company are going ahead with their work in Bloomington, and expect to get under operation by Nov. 1st. The capacity of the plant is 250 lights, and 145 city lights and 50 commercial lights are already contracted for. The company has purchased a piece of land 50 × 100 feet, upon which it will erect a handsome station. The New York Safety Steam Power Company, W. A Hammett, Western manager, furnishes the engines. To show how these lights will be distributed all over the city, it might be mentioned that over 1,100 poles will be used in placing them.

A. L. Ide & Son, of Springfield, Ill., manufacturers of the well-known Ide automatic engine, are opening an office in the *Times* building, Chicago.

Mr. H. A. Streeter, President of the Globe Engineering Works, 39 Indiana street, Chicago, reports the following late sales of Amet electric governors: Butte Hardware Company, Montana; New Jersey Steel & Iron Works, Trenton; Bain Electric Company, Chicago.

The suit of the United States government, prompted by the National Improved Telephone Company, of New Orleans, against the American Bell Telephone Company for the anulment of the latter company's patent, is exciting no less attention in the West than in the East. The local papers have taken it up, and the National Improved Company's stock seems likely to receive all the advertising which its stockholders could desire.

I had a talk with Mr. Van Benthuysen, President of the National Improved Telephone Company, at the Grand Pacific Hotel, the other day. He seems very hopeful in regard to the outcome of the suit, and expects a favorable decision from the lower courts in three or four months, after which his company will be able to go ahead without fear of injunction. He presumes the Bell Company will appeal from the decision of the lower court, but he has no fear of the first decision being reversed. As soon as they get the expected favorable decision from the lower court, the National Improved Company will commence to put in plants right and left, according to my informant, and to compete vigorously for a share of the telephone business. This they are already doing in several cities in the South, and are offering subscribers much better terms than they get from the Bell companies. Mr. Van Benthuysen denies the assertion that this is a stock jobbing scheme, and declares it to be a legitimate business enterprise. He also denies the charges made against Attorney-General Garland, and says they are only made by partisan newspapers for political effect. He says the proof offered to the government was so overwhelming that there was no way in which it could avoid bringing the suit.

Mr. Van Benthuysen claims that they have better instruments than those commonly in use, and charges that the Bell Company does not give the public the benefit of the latest improved apparatus. He has the history of all former telephone suits at his tongue's end, and has evidently given the whole question a good deal of study.

One of the central features of the southern portion of the main hall of the Interstate Exposition now in operation here is the handsome exhibit of the McIntosh Galvanic and Faradic Battery Company, of Chicago, noticeable among which is a large and handsome case filled with scientific and electrical instruments and appliances of all kinds. The Van Depoele Electric Manufacturing Company, of Chicago, have also an interesting display of dynamos and motors in the main hall of the Exposition. The electric lighting apparatus is exhibited in full operation and the motors are driving various pieces of machinery. The Exposition Building is lighted throughout by the Bain electric light, to the entire satisfaction of the Exposition managers.

Among the engines exhibited at the Exposition are the Corliss, the Buckeye and the New York Safety Steam Power Company's. The Davey safety engine is also on exhibit, and some tests of this motor for electric lighting purposes are being made, the results of which I hope to send you later. The Shipman engine, manufactured at Buffalo, N. Y., and burning kerosene, and the well-known Otto gas engines, are shown in operation.

The local *Herald* has the following:

The attorney for the Schuyler Electric Light Company yesterday filed an indemnity bond before Commissioner Cregier against any damage that they might have done in running their wires across certain streets of the city. A short time ago the company ran its wires across State street between Monroe and Adams. The city immediately cut the wires, but, on request of the company, did not remove them, as is the custom, as the company desired, if possible, to obtain an ordinance or have adopted some means whereby they can use their wires. It is claimed that the Underground Conduit Company has virtually a monopoly of the conduit system in the city, and that whenever a company which does not rent from it attempts to cross the street with their wires they are prohibited.

Mr. C. B. Brodie, representing the Consolidated Electric Company, of London, England, was a caller at this office this week. His company operates the Beeman, Taylor and King electric lighting patents in England, and his mission here is to make some arrangement looking to the introduction of their apparatus in the United States. They run both arc and incandescent lights from the same machine, operating the dynamo in the day time to charge their improved storage batteries with sufficient electricity to run the incandescents during the night, and using the machine at night to run the arc lights. Their accumulators are claimed to be a great improvement over the Brush, and the system has worked with perfect success for twenty-seven months now, which leads them to think that they have solved this important problem. They are able to compete with gas at three shillings and sixpence (84 cents) per thousand. Mr. Bodie is at 32 Adams Express Building, Chicago.

Another important electric-lighting deal has been made here. I have already given you the particulars relating to the arrangement which the electric lighting companies have with the City Conduit Company for the South Side (the main business portion of the city) and which has led to greatly increased activity in electric lighting in this division. I am now able to chronicle the fact that the North and West divisions have also been placed in a position where consumers can get electric lights as fast as they want them. The Thomson-Houston Electric Illuminating Company, of Chicago, has been organized, and has rented from the local conduit company all the available mains on the North and West sides. The company is already at work on the North Side, and expects to have 100 arc lights in operation there by the latter part of next week. Work will immediately begin on the West Side, and the company expects to have 1,000 arc lights burning in the two divisions within six months. They will use the Thomson-Houston arc apparatus, and the Mather incandescent. Unusually fine stations will be erected, and the equipments will be first-class in every respect. Further particulars will follow as the work progresses.

The officers of the company are J. W. Chisholm, President; F. Butterworth, Secretary; J. H. Hapgood, General Manager; Alex. F. Greig, Treasurer. This arrangement lifts the incubus from electric lighting on the North and West sides, and puts these divisions on an equal footing with the South division in this respect. The whole city is now thrown open to electric lighting, and the boom which was predicted in this column some time ago is well under way.

Western telephone stocks, as quoted by Col. S. G. Lynch, 144 La Salle street, Chicago, stand as follows: Central Union, 50 b, 53 a; Michigan, 68 b, 70 a; Iowa Union, 20 b, 23 a; Great Southern, 28 b, 33 a; United, 14 b, 15 a; Missouri & Kansas, 55 b, 57 a; Rocky Mountain Bell, 45 b, 50 a; Chicago, 375 b, 400 a.

CHICAGO, Oct. 12, 1885.

The Van Depoele Company have lately installed 12 arc lights in Mason & Davis' foundry, at Grand Crossing, Ill.; 40 arc lights at Winona, Minn.; and 200 incandescent lights in Wm. Deering & Co.'s establishment, Chicago.

The Dayton Carbon Company, of Dayton, O., are pushing the sale of their goods in the West.

Last Tuesday evening West Indianapolis was lighted with the electric light furnished by the Jenney Electric Company, according to their contract. They have 18 lamps in use, giving good satisfaction.

Judge Taylor, Indianapolis, has set Oct. 13 as the day for the final hearing of the telephone case. So far the Judge holds that the law in saying telephone means the old telephone with all improvements. I notice an item in the papers from Evansville stating that a suit which had been brought by parties there against the local telephone company, to compel them to furnish a telephone and all necessary connections at the legal rate, as established by the last Indiana Legislature, of $3 per month, has been decided against the telephone company. The Judge held the law constitutional, and that the word "telephone" in the law means all the necessary connections and instruments.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Oct. 14, 1885.

The audience at the new Temple Theatre, Philadelphia, was photographed, and each person attending presented with a picture, on Monday evening, Oct. 12. A twenty thousand candle-power electric machine, was built by the Brush Electric Company especially for Messrs. Havlin & Erlanger, whose patent process was used in making the photograph.

Messrs. Partrick & Carter, Philadelphia, Pa., report trade as good in their line. They are about putting on the market a new medical battery, for which they claim great efficiency. They have recently fitted up their large factory and salesroom with electric light.

The Phosphor Bronze Co., of Philadelphia, report a general awaking of trade in their goods.

The exhibit made by A. F. Fleishman of his electrical appliances at the "Novelties" attracts large crowds of visitors. His small electric motor which he has here, receives much comment and commendation.

The Edgerton motor is be seen at work at the "Novelties." It has been used to run the small "traction" car exhibit.

The Electric Matting Company, of 35 Market st., Camden,

N. J., has established a branch office at 1512 Chestnut st., n this city.

The small Burnham engine which is exhibited at the "Novelties" seems to possess all the features for a good electric light engine.

THE TELEGRAPH.

A Cable Dividend.—The Anglo-American cable dividend is announced at five shillings per share against ten last year.

Keene, N. H.—The city of Keene, N. H., will shortly introduce the fire-alarm telegraph, for which a contract has been awarded to Mr. Geo. M. Stevens, of B ston.

Canadian Extension.—It is stated on the very best authority that the Canadian Pacific Railway Company will immediately begin an extension of its telegraph lines throughout the Dominion, for which power is given to it by act of Parliament. It is understood that it has given a large order for wire, and will complete its connection with the telegraph system of the United States. In this case the Canadian Pacific will become a formidable rival of the Great Northwestern Telegraph Company, which now enjoys a monopoly.

Troubles at Cleveland.—A dispatch of Oct. 10 from Cleveland, O., says: The trouble which has been brewing between the Western Union and the Bankers & Merchants' Telegraph companies came to an open rupture last night at the Connotton Valley railway station. It is claimed that the Western Union men cut the wires of the Bankers & Merchants' just below the Connotton Valley station. J. A. Simmons, manager of the Bankers' & Merchants', with a force of men repaired the damage and disconnected the Western Union wires.

Underground in Detroit.—Work was begun in Detroit, Mich., on the 29th ult., to put all telegraph, telephone and electric light wires under ground, Dorsett's conduit system being used. Six miles of these conduits are to be laid this fall in the heart of the city, where the wires are the thickest. Each conduit has seven separate ducts or channels, through which the wires are run in cables. Access is gained to the conduit through man-holes stationed 400 feet part. A separate conduit is laid for electric light wires, although it is claimed that this is not actually needful.

A Smart Telegrapher who Overreached Himself.—A dispatch from Oil City, Pa., on the 6th inst., says: Mike Keating, a member of the Oil Exchange, has failed. His liabilities are not known. Five years ago Keating was employed as messenger boy by the Western Union Telegraph Company, and having access to telegrams soon learned the cipher of the Standard Oil Company. Seeing a telegram from them to a broker reading: "Buy all oil offered without limit," young Keating took it to a broker named W. H. Gufer, who consented to purchase 200,000 barrels of oil and give Keating half the profits. In the course of a month he unloaded the oil at a profit of $80,000. Had he held on a month longer he would have doubled the amount. He soon joined the exchange, where he has recently lost heavily.

The Effect of the Sixpenny Telegrams in England.—To meet the great pressure of business consequent upon the reduced rate, about 20,800 miles of new wire have been erected on new poles. At the various offices in London, and the districts of London where pneumatic tubes take the place of working by wire, an additional four miles of tubing will be used to meet the pressure. A new tube-room has been specially prepared in the basement of the Central Telegraph Office. An additional number of 40 Wheatstone automatic telegraph instruments have been purchased. These instruments, which are of the latest and most improved pattern, are capable of telegraphing upward of 500 words per minute. The following instruments have also been purchased: Eight quadruplex and 300 duplex sounders, 350 single-current sounders, 150 single needles and 10 repeaters. These are in addition to the duplex system, which will be completed in the case of 100 circuits. To work this enormous increase, the staff, in the United Kingdom will be augmented to the extent of 1,200 telegraph clerks and over 1,000 messengers.

THE TELEPHONE.

Changes at Harrisburg, Pa.—There are several changes in the telephone office at Harrisburg, Pa. Mr. Charles O. Harris, the chief inspector, is succeeded by J. Albert Kelly, of Philadelphia, formerly of Harrisburg. Mr. Harris goes to Easton to accept a position as division engineer in the Eastern telephone district. Milton Brandt leaves to accept the position of division cashier at Reading. He is succeeded by E. W. Dasher, a clerk at the Philadelphia & Reading depot.

Trying Brown's Telephone.—A dispatch from Philadelphia of Oct. 11 says: A test talk with the new magnetic telephone was made to-day between Paramus, on the Erie Railroad, and Conshocken, by the inventor, Frederick H. Brown, Mayor John J. Safeley, Electrician Barberee, of the United Lines and Postal Telegraph Company, and others. The distance is 125 miles. Operations continued for an hour and a half. Conversation was carried on in an ordinary tone over a wire of the United Lines, and the test was in every way successful.

The Telephone at Fort Smith, Ark.—In its special trade issue, the Fort Smith *Times* has the following, on the local telephone exchange: On Sept. 8, 1883, the telephone exchange in this city was formally opened by Mr. Geo. Tilles. Numbering but a few subscribers at first, it has gradually grown until now our citizens are telephonically connected by over fifty miles of wire, and find its use almost indispensable in the pursuit of their vocations. Branch lines extend in all directions; almost every town of note within a radius of sixty miles is connected with Fort Smith by telephone. To our merchants this forms an invaluable mode of easy and rapid communication with their country customers, and is highly appreciated. Mr. Tilles' management gives entire satisfaction. The operators employed by him are polite and attentive, and every endeavor is made to give prompt and efficient service to his patrons.

A Telephone Exchange without Operators.—A man residing in this city, says the Salem *Evening Telegram*, recently invented an automatic telephone switchboard which is sure of much favor and utility. The mechanism of the new invention is such that immediate telephone connections can be made by one subscriber to another, without the aid of an operator at a central station, and when the telephone is hung on the hook the mechanism is returned to its original place. The invention is such that no third party can interfere with the conversation taking place between the persons using the line. The new switchboard will prove of much value in places where the telephone company will not go to the expense of hiring an operator. If the invention is adopted for general use, it will prove a great saving in the expenses of the telephone service, and, it is hoped, will cause a reduction in rents of the popular yet expensive talking machines.

The Telephone Patent Suits.—In a just determination of the controversy the public has a much deeper interest than the rival claimants. The question involved is one of fact, concerning which there should be no prejudice on one side or the other. If it should be proved that Graham Bell was the original inventor of the speaking telephone, all the enormous privileges that rest upon his patent will be sustained, grievous as the burden is becoming. But if it be judicially ascertained that he has no valid claim to priority over a number of other inventors, a great monopoly will be overthrown. There is no room for the display of sympathy or sentiment on this question. Bell and his associate patentees have become enormously rich by their monopoly, and they will not suffer if the Courts should decide, upon a full investigation of the facts, that the exclusive merits of the speaking-telephone invention do not belong to him. On the one side is the public policy which encourages science by giving to inventors for a limited time an exclusive right to their discoveries. On the other is the public policy which protects society against special privileges and monopolies founded upon wrongful and false claims. The chief interest which the country has in this question is that exact justice shall be done to all concerned.—*Philadelphia Record.*

THE ELECTRIC LIGHT.

New Companies.—Electric light companies have been organized at Steubenville, O., Mansfield, O., and Newton, Kan.

Deane Steam Pump Works.—A contract has been awarded to the Schuyler Company for lighting the Deane Steam Pump Works, Holyoke, Mass.

Rutland, Vt.—This village was lighted by electricity on Oct. 3 for the first time, by the new electric lighting company. There are 253 Edison incandescent lights used, of 16 candle-power, in about 40 of the leading business houses. The light gives satisfaction.

The Use of Search Lights.—While H. M. S. Dreadnought was exercising her electric search lights at Malta a short time since, an engine-room artificer fell overboard, the sea being rather choppy at the time. By means of the electric search lights the poor fellow was seen struggling in the water near a life buoy, but unfortunately he sank before the boat could reach him.

Phenomenon Regarding Incandescent Lamps.—A correspondent of a contemporary says: "In testing incandescent lamps, one sometimes finds one which presents the double peculiarity of running "dull" and of the glass becoming unusually hot. If the lamp is worked it soon blackens and breaks, and sometimes I have broken the glass and noticed that the report produced was less than usual. I have always set down such lamps as having a bad vacuum, and imagined that convection and conduction by the inclosed gas molecules accounted for the phenomenon. This idea is supported by the similar behavior of a lamp which gets cracked slightly while burning. May not a partial vacuum be a better heat conductor (as it is a better electrical conductor) than air at atmospheric pressure?"

To Utilize Water-Power.—The wonderful success that has attended the experiment of running the electric lights on the Dufferin Terrace, at Quebec, by the motive power of the Montmorency Falls, is likely to be followed by other results of a very practical and far-reaching character. In addition to the project of an electric railway to run along the almost dead level of the beach from Quebec to La Bonne Ste. Anne, with the prospect of handsome profits from the carriage hire alone of the 80,000 to 100,000 pilgrims who annually visit the shrine, a company is already forming to run in the same way and from the same source, the machinery of all the manufacturing, printing and other industrial establishments of Quebec operated by steam. The machine intended to furnish the current has been ordered, and is expected to arrive within a month. It is calculated that the wires now used to transmit the current to the electric lights at night may be used in the daytime to convey power to the factories.

Auburn, N. Y.—Mr. Jos. Wills, the Superintendent of the Brush-Swan Electric Light Company, at Auburn, N. Y., says: "The Brush Swan plant at Auburn is doing well. All summer we were running full, but as fall came on they began to crowd us for lights, so the Brush Company of Cleveland, in whose hands the plant is at present, sent us a 50 h. p. Armington & Sims engine and a 60 h. p. Babcock & Wilcox boiler. The new power and dynamo were put in operation on Saturday, Oct. 3, for the first time. The capacity of the plant now is one hundred and twenty-five 2,000 c. p. arc lamps and one hundred and fifty 16 c. p. Swan incandescent lamps. We have five sets of seven 16 c. p. Swan lamps each, on our arc circuit, run on the Brush multiple series cut-out system, and the demand for them exceeds the supply. The orders on the books for lamps will fill up the new machinery to its full capacity as soon as we can get the remainder of our lamps, as the present Brush Company are so rushed with orders that we have to wait our turn."

APPLICATIONS OF POWER.

Running the Daft Motor.—Another trial of the Daft electric motor was made, on the 12th instant, on the Ninth avenue elevated road. The motor drew two cars, which carried about 100 persons from the Fourteenth street station to the Fifty-third and back again. The trips were both successful, the motor drawing the cars rapidly and more smoothly than a steam engine usually does. Among those who rode behind the motor were Cyrus W. Field, Mayor Low, of Brooklyn; Vice-President Gallaway, of the Elevated Railroad; Edward W. Field, the Rev. Henry M. Field, and John H. Hall.

MISCELLANEOUS NOTES.

A Curious Effect of Lightning.—Among the lepers at the Misken Hané, at Scutari, is one who is said to owe his malady to a lightning stroke.

Good Insulators.—It is stated that liquid oxygen and nitrogen rank among the most perfect insulators. The resistance of copper decreases much more rapidly than the absolute temperature, and approaches zero at a temperature not very remote from that obtained by evaporating liquid nitrogen in a vacuum.

Struck by Lightning.—While a number of telegraph linemen were stringing wires between Derby and New Haven, Conn., on Oct. 4, they were caught in a heavy thunder-storm. Lightning struck a wire and followed it along to a post on which were three men. All of them received a severe shock. The man highest up from the ground threw up both hands and fell upon the man below him unconscious. He was lowered to the ground. On his breast were found three parallel marks. After some time he recovered consciousness. A farmer was at work in a field near by. His long boots were taken off his legs and he was badly burned by the lighting.

Imitation Leather.—By means of electricity the most attractive leather surfaces are now completely imitated. The leather which it is desired to imitate is first well cleaned and coated with graphite, as in electroplating a smaller article. It is then placed in a copper bath, the tank of which is large enough to receive easily a skin of any size. A dynamo-electric machine generating a powerful current furnishes the electricity. The copper is deposited upon the coated surface of the hide to a thickness of one-sixteenth to one-eighth of an inch. The plate thus formed reproduces, but reversed, every mark and minute vein of the leather, so that a print can be easily taken from it.

The "Special Delivery" System.—Ex-Representaveti Skinner, of New York, who was instrumental in securing the enactment of the law authorizing the establishment of the special delivery postal system, has written to the Post-Office Department for information respecting the workings of the new plan. Mr. Skinner has been informed that, as reports have not yet been received from all special delivery offices, it is too early to hazard an opinion on the result. From the reports received, however, it appears that nearly all postmasters speak well of the future of the system, and the business is increasing, the local matter equaling the outside matter in volume. Some reports are said to show that the letters generally have been delivered with surprising promptness. Reading, Pa., reports the average time required for delivery to be nine minutes, while letters have been received at the department building in Washington in seven minutes from the time they were dropped into the Post-Office.

Compound Winding.—For some time, says the London *Electrical Review*, discussions have been going on as to the originator of compound winding, and the claims of Paget Higgs, Edison and Brush have been severally put forward. In February this year the Anglo American Brush corporation of England applied for leave to the British Patent Office authorities to file a second disclaimer, which was duly opposed by Messrs. Crompton and Siemens Brothers, although not altogether successfully, and in August last the officers finally gave judgment in favor of the company. The ground being thus cleared for action, the Brush Company has lost no time in advertising in most of the papers and sending notices by post to all manufacturers of dynamos in England, warning them against infringing their patent. It may not be generally known that Mr. Brush has a United States patent for compound winding.

Science Teaching.—Technical education has been defined by Mr. Henry Cunyngham to mean instruction in the art of applying the discoveries of science to the requirements of modern industry. It is not scientific teaching in the strict sense, nor, on the other hand, is it mere craftsmanship. To take an example, the mode of treatment of electrical subjects given in the works of the late Prof. Clarke Maxwell is purely scientific and mathematical; in his hands electricity is an applied mathematical science. In the hands of Faraday electricity becomes an experimental science. But neither the teaching of Faraday nor of Maxwell is of exactly the kind that is suitable for a mechanic. Something more practical is needed; the body of truth must be arranged with a view rather to action than to knowledge. This requires a bent of mind that is midway between science and craft—it is the liberal part of the education of an artisan. We require manual dexterity guided by wide views and scientific knowledge.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 69, a 71; Am. Dist., b 28, a 29½; B. & M., b 1, a 1¼; Western Union, b 75⅝, a 75¾.

Telephone.—Am. Bell, b 181, a 182, Erie, b 26½; New England, b 28¾, a 29; Tropical, b ⅞, a 1.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Telephone Inventors.—See advertisement beginning "Wanted—Telephone Appliances," on page v, advertising columns.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected. The Eastern Agent is W. A. Wales 16 Maiden Lane, New York.

German Corn Remover

Kills corns and bunions, unfailing, rapid, painless; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
GALE'S HONEY, the great cough cure; 25c., 50c. and $1.
HLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.